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1806—1880

For forty-six years Professor of Medical Jurisprudence at Guy's Hospital Medical School.

Frontispiece

TAYLOR'S
PRINCIPLES AND PRACTICE
OF
MEDICAL JURISPRUDENCE

TENTH EDITION

EDITED BY
SYDNEY SMITH, C.B.E.
M.D.(Edin.), F.R.C.P.(Edin.), D.P.H.

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PREFACE TO THE TENTH EDITION

In this, the tenth edition of Taylor's *Medical Jurisprudence*, recent advances in the various medical and ancillary sciences, together with recent legislation by the British Parliament, have necessitated a considerable amount of alteration and revision in every part of the work. Whereas the essential features of "Taylor" have been maintained, the opportunity has been taken to revise and to modernise the text, and to clarify a number of passages which were previously somewhat obscure. In some parts; the arrangement of the book has been altered; certain sections have been entirely re-written; and a great deal of new material has been included. We have not considered it desirable to delete references to old cases simply because they are old; but where these could, with advantage, be replaced or supplemented by more recent case histories, this has been done. It is hoped that these changes will prove to have enhanced the value of the work.

In response to the suggestions of a friendly reviewer of the previous edition, we have omitted a large proportion of the technical details formerly given in the chapters on Insurance and Workmen's Compensation. The saving of space thus effected has been utilised with advantage in other parts of the work.

A further consideration which justified a curtailment of the space formerly devoted to the Workmen's Compensation Acts is the impending supersession of that Act by the new National Insurance (Industrial Injuries) Act, 1946.

The new Act will bring about a much needed change in the methods of dealing with compensation for injuries to employed persons. The superseded legislation, although of considerable social importance, tended to affect adversely many claimants for compensation. The examination by medical men for the two opposing parties; the giving of evidence in Court, and the long-drawn-out nature of the enquiry tended to produce a neurosis or to accelerate an existing tendency to a neurotic state which was not desirable. The conflicting opinions which medical referees and judicial authorities had to consider were neither creditable to the medical profession nor helpful to the ends of justice. As emphasised throughout the present work, any suggestion of the existence of partiality in a medical witness would be entirely contrary to the ethics of the profession. The new Act has been dealt with very briefly in its medico-legal applications, which is all that is possible or necessary at the present stage; it would seem, however, that many of the defects of the former legislation have been remedied.

No attempt has been made to provide detailed information regarding certain other legislative enactments, including the National Health Service Acts, which are important from both the medical and legal points of view. It does not appear, however, that they create any distinctly medico-legal problems or affect principles which are not already dealt with; and for that reason it does not seem necessary to consider them at length, at the present stage, in a work on medical jurisprudence.

The following statutes, among others which affect in varying degrees practitioners of medicine and surgery have been noticed in completing the revision of the text: The Public Health Act, 1936, the Matrimonial

Causes Act, 1937, the Factories Act, 1937, the Food and Drugs Act, 1938, the Mental Deficiency Act, 1938, the Children and Young Persons Act, 1938, the Infanticide Act, 1938, the Road Traffic Act, 1938, the Cancer Act, 1939, the Pharmacy and Medicines Act, 1941, and the Nurses Act, 1943.

The recent decisions of the English Courts of Law which have been referred to in the new edition include the decisions of the House of Lords in *General Medical Council v. Spackman*, and in *Lindsey C.C. v. Marshall*, the decision of the Court of Criminal Appeal in *Rex v. Bourne*, and the decisions of the Court of Appeal or of the High Court of Justice in *Mahon v. Osborne*, *Gold v. Essex County Council* and *Morris v. Winsbury-White*.

In the toxicology section, we have taken the opportunity of dealing with some of the drugs which, introduced into medicine in recent years, have been the causes of toxic reactions or fatalities, of which the sulphonamide drugs form the outstanding example. The general description of procedures in toxicological analysis has been re-written with a view to giving a clearer account of the available methods and their application. Throughout, newer methods of analysis have been described, but older methods have been deleted only where they are known to be unreliable. Thus the Marsh-Berzelius and Gutzeit tests for arsenic have been retained, but have been supplemented by a description of the newer titrimetric method.

The accounts of the mode of action and symptomatology of the various poisons have been carefully revised so as to include all important facts, but to eliminate the repetition that was to be found in earlier editions. Illustrative case records remain a feature of this section ; and have been chosen because of completeness or because of their striking nature rather than on the basis of date. Often old cases provide a fuller description than modern cases, and when this is so, the old have been retained.

The statistics given in this edition have been culled from the latest official returns published in respect of England and Wales.

We acknowledge with gratitude the invaluable help in the sections relating to coroners and witnesses' fees which we have received from Mr. W. Bentley Purchase, M.C., and Master W. Valentine Ball, O.B.E., respectively. We have to thank Dr. Robert Richards for his help in the chapter on alcoholic intoxication, Dr. James Davidson for his help in the chapter on blood grouping, Dr. F. S. Fiddes for his general help throughout, and many correspondents for their helpful suggestions.

SYDNEY SMITH.

W. G. H. COOK.

THE PRINCIPLES AND PRACTICE

OF

MEDICAL JURISPRUDENCE

CHAPTER I

INTRODUCTION

Definition and Boundaries of Medical Jurisprudence.
Medical Evidence.
Notes and Reports on Cases.
Depositions
Coroners' Procedure: Post-mortem Examinations.
Subpœna; its Authority.
Taking the Oath.
Evidence: Oral and Documentary; Examination-in-Chief.
  Cross-examination; Re-examination; Questions by Judge or Jury; Privilege of Counsel.
Quotations from Books.
Medical Privilege: Professional Secrecy.
Advice to Medical Witnesses.
Expert Evidence; Defects in the system; Remedies for these Defects.
Documentary Evidence; Affidavits, etc.; Notes and Depositions; Dying Declarations.
Presence in Court.
Fees.

Medical Jurisprudence—or, as it is more commonly called, FORENSIC or LEGAL MEDICINE, is a branch of MEDICINE, and may be defined as the science of the application of medical knowledge to the purposes of the law; hence its limits are, on the one hand, the requirements of the law, and, on the other, the whole range of medicine. Anatomy, physiology, pathology, pharmacology, medicine, surgery, midwifery, gynæcology, and the sciences ancillary thereto, *viz.*, chemistry, physics, botany, etc., all lend their aid as necessity arises; and in some cases all these branches of science are required in the same case to enable a court of law to arrive at a proper conclusion on a contested question affecting life or property.

The purpose of this work is to bring as far as possible within a reasonable compass those subjects which especially demand the attention of, and more particularly concern the duties of, the qualified physician and surgeon in his relation to the law. The definition given above implies necessarily that a medical witness should possess not only a theoretical and practical knowledge of all branches of medicine, but also a wide experience of human nature and the power of adapting his knowledge and experience to emergencies. He should be able to elucidate any difficult medico-legal question which may arise, and be prepared at all times to make a cautious selection of such medical facts, and a proper application of such medical principles, as may be necessary to enable a court of law to arrive at a just conclusion.

Medico-legal knowledge consists not so much in the acquisition of facts as in the power of arranging them, and in applying the conclusions to which they lead for the purposes of the law. A man may be a very skilful surgeon, or a very competent physician; his mind may be well stored with professional information; yet if he is unable by the use of simple language to communicate his ideas to others, his knowledge will be of little avail. One much inferior to him in professional standing and experience may make a better medical witness.

John Hunter stood at the head of his profession; and if sound professional knowledge could have qualified any man to act as a medical witness, Hunter was fully qualified. Yet this great man, when giving evidence in 1781 on a memorable trial for poisoning, was obliged to confess that he was unable to give a definite answer to the important question put to him. Hunter was the only professional witness called on the part of the prisoner to rebut the charge of poisoning the deceased by laurel-water. His cross-examination, however, rather strengthened the case for the prosecution; and the final question put by the court was: "Give your opinion, in the best manner you can, one way or the other, whether, upon the whole of the symptoms described, the death proceeded from the medicine (laurel-water), or any other cause?" His answer was: "I do not mean to equivocate; but when I tell the sentiments of my own mind, what I feel at the time, I can give nothing decisive."

The facts of the case[1] were that a young man, previously in good health, expired in convulsions about half an hour after taking a draught of rhubarb and jalap sent by his medical man with which it was alleged the accused had mixed laurel-water. The victim's mother observed that the draught smelt of bitter almonds when administered. Ten days after death the body was exhumed and examined by several medical men. The examiners did not open the brain and they did not investigate the condition of the intestines. No analysis either of the contents of the stomach or of the remainder—if any—of the draught was made. Hunter deposed that the appearances found in the stomach were ordinary *post-mortem* changes with which he was quite familiar, and that the symptoms with which the victim died were quite compatible with apoplexy or epilepsy. He admitted in cross-examination that the occurrence of the symptoms immediately after taking the draught was a circumstance in favour of its having caused them, and "if," said he, "I *knew* that the draught had contained poison, I should say that most probably the symptoms arose from that." He was, however, directed by the judge to separate the medical *facts* which he had observed from the suggestion that poison had been administered: and, on this direction, he declared that there was no direct medical evidence to show how death had been caused. The accused was convicted and hanged.

Analysing this case in the light of our present-day knowledge, so far at least as the medical evidence is concerned, the conviction seems to have rested almost entirely on circumstantial evidence. There can be no doubt that if death was due to poisoning at all, it was due to poisoning by a dilute solution of hydrocyanic acid; and the *post-mortem* evidence of that, apart from the smell and the chemical analysis, was indecisive. Hunter's evidence was as straightforward as his knowledge would permit, for the smell would probably have passed off in ten days, and there were then no means available for exact analysis of the contents of the stomach. The real flaws in the evidence arose from the incompleteness of the *post-mortem* examination and the difficulties of analysis which were then insuperable.

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[1] Palmer's "Life of Hunter," vol. 1, p. 81.

The variety of subjects of which a medical witness is required to have knowledge and experience may alarm a student of medicine, and lead him to conclude that, as he cannot make himself perfectly acquainted with all, he may well forgo the labour of qualifying himself in any. The above description of the qualifications necessary to constitute a good witness in a court of law should not deter a student from studying the subject. All that the law expects from a medical man is a fair average knowledge, not merely of his profession, but of those data which come more peculiarly within the province of a medical witness. The more completely a man has made himself master of his profession, the better will he be fitted to understand the principles, and to apply himself to the practice, of medical jurisprudence.

The duties of a medical witness are different from those of a medical practitioner : the latter is concerned with the treatment of disease or of accident, and the saving of life ; but the function of the former is to assist the law (*inter alia*), not only in identifying the perpetrator of a crime, but also in securing the acquittal of an innocent person from a crime wrongly imputed to him. Thus he may be required to determine whether, in a particular case, the cause of death was natural or violent ; and, for this purpose, it will be necessary for him to approach the matter from a different angle. He has to face the difficult task of making a selection from those parts of the medical sciences which bear upon the legal proof of and the investigation of crime.

Some members of the medical profession have been inclined to look upon medico-legal practice as an unnecessary addition to their ordinary duties, but there are few who have been engaged long in the practice of medicine who have not found themselves occasionally placed in positions of difficulty from the accidental occurrence of cases demanding medico-legal investigation. A medical man may be summoned to attend a person who is suffering from the effects of poison criminally administered, and at the time he may have no knowledge or even suspicion that poison is the cause of the symptoms. In spite of careful treatment, death may ensue. Here the functions of the medical man end, and those of the medical witness begin. It is impossible in these circumstances for him to avoid giving evidence, or to shift the responsibility to another : the law will insist upon his appearance, first before the coroner, and subsequently in a criminal court. It will be assumed that, as a registered medical practitioner, he is fully competent to answer every question put to him by the judge and by counsel relative to the general effects of poison, the quantity of a fatal dose, and the time within which death may ensue. His evidence may be objected to on the ground that the deceased had died from the effects of disease, and not from poison, in which case the examination will lead to a searching inquiry into all those diseases which resemble poisoning in their symptoms and *post-mortem* appearances, into the means of making a certain distinction between them, and into the fallacies to which the chemical processes for the detection of poison are liable. As he will inevitably be asked whether any traces of disease were present in any organ, the importance of making a *post-mortem* examination complete in all details is obvious.

On another occasion a medical man may be called to render assistance to one who in the course of a quarrel has been stabbed, and dies from the injury soon after having received the wound. Here the office of the physician or surgeon ceases, whereas that of the medical witness begins. He must now be prepared to answer questions, bearing upon the legal proof of crime, all of which may be necessary in law, although apparently superfluous in medicine or surgery. Thus he may be asked to state the precise appearance of a wound inflicted upon the body of a man, by what means and at what time it was inflicted, and whether it was caused as a result of accident, suicide or murder. What was the amount of blood lost ? Could the person have moved or performed any act after receiving the wound ? Are certain stains found upon his clothing or upon a knife belonging to him attributable to effused blood or to other causes ? Were any, and (if so) what, statements made by the dying man, and what were the precise circumstances in which they were made ? Unless a witness is able, when occasion requires, to return answers to questions of this kind, a guilty man may escape punishment, or an innocent man may be condemned. A medical man's qualifications as a physician, surgeon or general practitioner, however great, will not protect him in certain circumstances from the reproach of having caused a miscarriage of justice. Again, the dead body of an infant is, to a physician, a corpse, and nothing more ; but to the medical witness it is a human sphinx from which he is expected to extract answers to many questions : Was it mature or immature ? Could it have been, and was it, born alive ? If so, how long did it live ? Was it killed, and if so, how ? Or did it die a natural death ? If so, from what cause ? Upon the answers to these questions may depend the life of a fellow-creature, or perhaps the honour of a woman.

The duties of a medical witness are therefore of a highly responsible nature and of great importance to society ; and any medical practitioner, even in the most retired corner of the kingdom, may suddenly find himself summoned as a witness in a trial to answer questions which perhaps during a long period of practice he had been led to regard as trifling and unimportant.

MEDICAL EVIDENCE

Some medical men who have treated forensic medicine with indifference have occasionally ventured to appear as witnesses, and have believed that the subjects on which they were likely to be examined were so much beyond the knowledge of the judge and of the lawyers engaged in the case that even hazardous or rash statements would escape observation. Many lawyers possess a good deal of medico-legal knowledge ; and they are able to detect when a witness is attempting to avoid giving a proper answer by vague or evasive statements and by the use of technical language. Counsel engaged in any civil or criminal case of importance take care to inform themselves of the views of standard medical writers ; and they are not likely to be put off by an erroneous or evasive answer to a medico-legal question.

It is certainly a fault of medical men that they are often not prepared for the complex and difficult questions which are likely to arise in a case upon which they know they will be required to give evidence. This lack of preparation applies to facts as well as to opinions. For instance, in a case of death which may result in a charge of murder or manslaughter, a medical man who attended the deceased may often omit to observe many circumstances connected with the case because they appeared at the time to be irrelevant or of little importance, although at the subsequent trial he may find that upon them depends the final issue. As a result of professional habit, medical observation is, on these occasions, confined as a rule to only one set of circumstances, *i.e.*, the diagnosis and treatment of disease or personal injury; but medico-legal observation should take a much wider range, and should be directed to all the surrounding facts and incidents of the case. Circumstances which are of no interest from a medical or surgical point of view are often of the greatest value and importance in legal medicine. If all these facts be not observed by a medical witness upon his first dealing with the case, it may be beyond his power to answer many questions which must arise during the trial. The lack of careful observation is a serious matter, and may result in an imputation of professional ignorance.

The first duty, therefore, of a medical practitioner is to cultivate a habit of accurate observation, the exercise of which is by no means inconsistent with the performance of the duties of a physician or surgeon. Some medical men possess this power in a remarkable degree, as the following incidents show:

Sir Astley Cooper was called to see a man who, while sitting in a chair in his private room, had been mortally wounded by a pistol-shot fired by an unseen person. Sir Astley having attended to the wound, compared closely the direction from which the pistol was fired with the position of the wounded man, and came to the conclusion that the pistol must have been fired by a left-handed man. The only left-handed man known to be on the premises at the time was an intimate friend of the deceased, against whom there was no suspicion; but this acute observation led to the arrest and trial of the friend, and to his subsequent conviction for murder.

In another case of murder the victim had been stabbed in the chest and died almost instantly from a wound in the heart. The act had been perpetrated in the dusk of the evening by someone in a crowd, but no one was seen to strike the blow, and no weapon was found near the spot. The surgeon observed that the wound in the chest was sharp at one angle and rounded at the other; and he gave his opinion that the wound had been inflicted with a knife having one sharp edge, and not with a dagger or double-edged knife. Within a few hours after the attack a man was arrested on suspicion, and a knife which he attempted to conceal was taken from him. It was in a sheath, and had at this time *wet* blood upon it. It was a pointed knife, with a broad blade, and one sharp edge only, and was such a weapon as, in the opinion of the surgeon, would have produced the stab in the chest. The man was convicted.

The condition and position of the body of a person who has died from wounds, the position of any weapon found on the scene, and the condition of the clothing and of the weapon, as well as the form and direction of the wound itself, are not always noticed with sufficient accuracy.

On the other hand, lack of observation may lead to the acquittal of guilty persons.

A woman was found dead in her bed. The scalp was lacerated and there were grounds for believing that the wounds had been produced by criminal violence. For the defence it was suggested that, as there were projecting nails at the head of the bed, these lacerations might have arisen from accident — a suggestion which was supported to some extent by the medical evidence. An experienced witness, however, stated that from his examination he did not believe that the nails, even if they were in the bedstead at the time of the occurrence, could have produced the wounds. He said also that as blood had issued from the wounds, and as there was no blood upon the nails or upon the part of the bed around them, he did not believe that the head had at any time come into contact with the nails. Those who were first called to the dead body had omitted to notice whether there was anything on or near the bed to account for the wounds on the scalp, *and they were quite unable to say whether there were or were not any projecting nails at the head of the bed when they first examined the body.* The accused was discharged on the Scottish verdict of "Not proven"; and there was some reason to believe that he escaped through manufactured evidence, in that the nails had been driven into the head of the bed subsequently to the death of the woman. It seems perfectly clear, however, from a general view of the medical evidence, that the wounds could not have been produced by nails in the manner suggested, and that the wounded portion of the scalp had not at any time been in contact with them. Inasmuch as the wounds were lacerated, and thus might have been produced by nails, the accused was given the benefit of the doubt which in this way had been raised in the minds of the jury.

The judge who tried this case remarked that "*a medical man, when he sees a dead body, should notice everything.*" A medical man should make it a rule to observe everything which could throw a light upon the production of wounds or of other injuries found upon the dead body. It should not be left to the police to say whether there were any marks of blood on the clothing, or on the hands of the deceased, or on the furniture in the room. The clothing of the deceased, as well as the body, should always be closely examined by a medical man at once and on the spot. The importance of this precaution is well illustrated by a case in which a man escaped committal, on what would have proved a false charge of murder, by reason only of the examination of an article of clothing which was accidentally produced at the adjourned inquest.

Another matter of great importance which is frequently omitted when examining a dead body is the duty to observe whether at the time of the examination the body or any part of it was cold, or warm, whether the limbs were cold and rigid, or cold and pliant. From a medical or surgical point of view, these conditions of the body are of little importance; but, if these facts be observed, they may enable a witness to speak with greater or less probability as to the time of death; this may make all the difference between the acquittal and conviction of a person charged with murder. The circumstances which chiefly require notice on these occasions have been fully described in the chapter on Wounds. In cases of supposed death from poison, other matters also will require special attention. These will be found in detail in the chapters on Poisoning.

One of the chief purposes of counsel when defending persons charged with murder or manslaughter is to endeavour to discover what the medical man engaged in the case omitted to do. Although sometimes the omission may be of no medical importance whatever, yet it may be placed before the jury in such a strong light that the accused may obtain the benefit of a doubt and secure acquittal. The omission may be attributed to professional ignorance, or (what is worse) to professional bias—a determination to find proofs of guilt against the "unhappy prisoner at the bar"—when the facts might easily be explained by the witness's lack of experience in dealing with cases of this nature.

In *R.* v. *Smith*[1] (the "Brides in the Bath" case) it was held that medical evidence in the form of opinions by medical witnesses is admissible as evidence if such opinions are given in the exercise of professional skill and knowledge with regard to assumed facts.

[1] (1915), 25 Cox, 271.

NOTES AND REPORTS ON CASES

In the ordinary course of practice there can be no doubt that the more complete are the notes which are kept of every case of sickness the better it is for the patient and for the medical man in the event of there arising any question which might necessitate the production of such notes, whether they be kept in a day-book or not. Such notes may be of great service in refreshing the mind of a medical man when he is called upon to answer a question bearing upon an antecedent illness. Every medical man should keep notes of all his cases. Whereas to a very busy practitioner such a course may be impracticable, it is of the utmost importance that all medical men should make as copious notes as possible immediately there is the slightest degree of suspicion that any case may ultimately become the subject of a medico-legal inquiry; this is especially to be emphasised in the case of an accident, however trivial, inasmuch as, quite apart from the Workmen's Compensation Acts, legal redress is frequently sought by those injured through accident.

When it becomes certain that a case will eventually be the subject of legal inquiry it is the duty of the medical man to commit to writing at the earliest possible moment everything which he has observed of the case hitherto, as well as everything which he is then able to observe, and, if the case does not terminate at once or has not already terminated. everything which he may observe in its further course. In various parts of this work (*e.g.*, in the chapters on "Rape," "Wounds," etc.) special reference will be made to the notes which ought to be taken. The medical man's own observations must be kept distinct from information given to him by others; he may draw conclusions of value from the former, but the latter must be proved before any conclusions can be drawn therefrom.

Many weeks may elapse before a person charged with the crime of poisoning is brought before the judge and jury. However clear the circumstances may appear to a medical practitioner at the date of his examination of the body, it will require more than ordinary powers of memory to retain for so long a period a distinct recollection of all the facts of a case. If no notes have been made, and the memory be defective, the case may result in favour of the accused, and the administration of justice suffer through the neglect of the medical witness. The law relative to the admissibility of notes or memoranda in evidence is very strict, and, in trials for murder, is rigorously enforced by the judges. In order to render such notes or memoranda admissible, it is essential that they should have been made by the witness at the time when the observations were made, or as soon afterwards as practicable; further, a witness is allowed to refer to such notes only for the purpose of refreshing his memory. He cannot read them audibly in the witness-box, thus giving them as his evidence; but he may, and usually does, read them there to himself. If he is known to have such notes, he may be required to produce them. He need neither be afraid nor ashamed to produce dirty or bloodstained notes of an autopsy, for example. Dirt does not destroy their value, and may be evidence of *bona fides*—by the inference that they were in fact made at the earliest moment.

At a trial for murder some years ago the judge commented on the medical evidence as follows:

It was also unfortunate that the doctor first called in (Dr. D.) had not made a proper examination of the deceased and had taken it for granted that because she was dead she must have fallen against a chest of drawers. Dr. B. also was most inaccurate. He (his lordship) had always found that when a witness said he had such a good memory that he took no notes, that witness was either very vain or very inaccurate. Dr. B. said that he found two pieces of lead behind the tongue, whereas, in fact, he did not find them at all. His partner found the pieces. These points were not vital to the case, but they were, at any rate, important points.

It is not in criminal cases only that notes ought to be made and preserved, for in civil cases it happens frequently that there is a very long interval between the occurrence of an accident or an illness and the trial of the case which arises therefrom.

Reports of Cases of a medico-legal nature are very frequently demanded from medical men, and such reports will necessarily be based upon the notes referred to. All such reports should consist of a summary of the medical facts, and of the conclusions based upon them, expressed as far as possible in non-technical language.

Such reports necessarily vary in their contents according to the nature of the case. The history of a poisoning case will differ materially from that of a cut throat, for instance ; but there are a few rules which are applicable to the proper drawing up of all such reports, and they merit careful consideration.

(*a*) Dates. These must in all cases be stated very carefully, and in such a manner as to leave no room for doubt, and to make it unnecessary to refer to calendars ; *e.g.*, a phrase such as " Last Saturday I saw Mr. Jones " must never occur ; it must run thus : "At 11 a.m. on Saturday, 26th January, 1946, I saw Mr. John Jones, of No. 5 Prospect Place, Kensington." Careful distinction must be made between the date upon which the events took place and the date when the report was made.

(*b*) The sex, age, and occupation of the person reported upon are matters which should be noted accurately.

(*c*) In drawing up a report on symptoms and on appearance after death, the facts should in the first instance be stated *seriatim*, plainly and concisely, in language easily intelligible to non-professional persons. A report should be made not to display erudition, but to be understood. If technical terms are employed, the meaning thereof should be stated in parentheses.

(*d*) A record of facts should not be encumbered with any opinions, inferences, or comments. The facts should be stated first, and the conclusions should be stated later in the report. The language in which the conclusions are expressed should be precise and clear. It must be remembered that these are intended to be a concise summary of the whole report, upon which the decision of a magistrate, or the verdict of a jury, may ultimately be based. Such conclusions should be confined strictly to the matters which are the subject of inquiry and have actually come under the observation of the witness.

(*e*) At the end of the report should be placed deductions from the facts described. Conclusions should be based upon *medical* facts only, not upon moral circumstances, unless the reporter is specially required to express his opinion in regard to them in cases where they are of a *quasi*-medical nature. Further, they must be founded only upon *what he himself has seen or observed.* Any information derived from other persons should never be made the basis of an opinion in a medico-legal report. A conclusion based upon mere *probabilities* is of no value as evidence.

Notwithstanding the plainness, simplicity, and obvious nature of these rules, they are all broken far too frequently. It is desirable to call further attention to the most frequent lapses. Statements are drawn up sometimes in exaggerated language ; at others they are overloaded with technical and unintelligible terms, and the writer is often not sufficiently careful to keep the facts distinct from his comments and his deductions from the facts. Whereas facts may be useful as evidence, the comments and deductions of a witness are usually inadmissible.

In regard to the first of these defects, too often it is the practice of medical men to use exaggerated language when writing reports of medical cases for professional purposes. Thus, in the writing of a report on an ordinary *post-mortem* examination, the lining-membrane of the stomach may be described as being " intensely " inflamed, or some part as " considerably " injected, or a cavity as " enormously " distended. Expressions employed in this loose manner convey to the legal mind a meaning widely different from that intended by the reporter. In addition they create great difficulty in evidence if withdrawn or modified, a change which, although other circumstances may show to be necessary, may at the same time place the witness in an undesirable position before the court. If such descriptions involve a comparison with similar conditions in other dead bodies, the question at once arises as to the standard by which they are measured, and as to the opportunity which the witness had of creating such a standard. As a rule it will be found that these terms have been used without proper consideration, or from a habit acquired from reporting cases for the information of medical men only. Let the medical man who is inclined thus to express himself bear in mind that lawyers look much more closely to the strict signification of words than do most medical men, and that they are disposed always to distrust the judgment of a person who cannot speak or write without employing the superlative degree.

Medical men who freely employ technical terms when writing reports must bear in mind that they are reporting not to a medical society, but for the information and assistance of a tribunal, the members of which may never have heard of the terms used. In a report on the appearances in the body of a man who had suffered from chronic insanity, the following passage occurred : " The only morbid appearance in the brain was an atheromatous deposit in the Pons Varolii, near the situation of the locus niger." In another document the medical reporter stated, for the information of a coroner's jury; that the " integuments of the cranium were reflected, and the calvarium was exposed." Educated persons, such as judges and stipendiary magistrates, do not as a rule include the meaning of technical medical terms within the range of their knowledge. Only a few of them understand the difference between perineum and peritoneum, or the meaning of the words hemispheres of the brain, pia mater, corpora quadrigemina, centrum ovale, etc. They are not likely to know the difference between the cardia and pylorus, or the nature or situation of the duodenum, jejunum, ileum, or cæcum, and are as ready to consider them to be parts of the liver or urinary bladder as of the intestines. On one occasion a learned judge asked for an explanation of the meaning of the term " alimentary canal." A slight consideration will show to any medical practitioner that technical medical language is quite out of place in a report which is intended to inform ordinary persons upon plain matters of fact.

Facts and comments upon facts, as well as hearsay statements and arguments, are sometimes found in combination. The facts alone are for the jury; the reporter's comments upon the facts may or may not be accurate or relevant, and unless relevant cannot be accepted as evidence. As a rule, nothing should be entered in a report which is not connected with the subject of inquiry, and which has not fallen directly under the observation of the reporter. The introduction of hearsay statements—*i.e.*, statements made by persons not called as witnesses—or of circumstances which have come to his knowledge through rumour, should be avoided.

At the trial of M'Lachlan for murder, discussion arose upon what should and what should not find a place in a medical report. A report was put in in which the police surgeon, who had been authorised to make a *post-mortem* examination of the body of the deceased, stated, at the beginning of his report, that the body had been found, "*under circumstances of great suspicion,*" in a front room, etc. The judge remarked that this was matter which was not suitable for inclusion in a medical report. Moreover, with reference to the conclusions drawn, the first and third were as follows :—

1. "That this woman" (the deceased) "was *murdered*, and that with extreme ferocity."

3. "*That a severe struggle had taken place before death.*"

The suggestion of murder was an anticipation of the verdict of the jury. The conclusion should have been merely that death had been caused by certain specified injuries. There was no evidence of any struggle so far as the *post-mortem* examination went. The facts upon which the witness relied as evidence of a struggle were consistent equally with the dragging of the body after death.

In a medical report of an analysis in a case of suspected poisoning, it is not necessary that all the details of the analysis should be given. A general statement of the results, to the effect that certain tests and processes had been used, will be sufficient, provided, of course, that the witness keeps a complete record of every part of the examination for production if required.

In the various analyses connected with the case of Cook and Ann Palmer[1] an application was made to Dr. Rees and Dr. Taylor to give to the prisoner's attorney, before the trial, a statement of the whole of the details of their analysis of antimony and of strychnine. They declined to do this without authority. The Court of Queen's Bench was appealed to, and Lord Campbell decided that there was no legal ground on which such a demand could be enforced. Inasmuch as the medical evidence against the prisoner was clear and conclusive, the counsel for the Crown advised that they should concede the point, although it was admitted to be in accordance with neither law nor custom. Upon this advice they acted, but it is not recommended that any scientific witness should follow such a course in future. The result was that, before the trial, these memoranda were placed in the hands of some chemists retained for the defence, with a view to hostile criticism. Portions of them appeared before the medical evidence had been given in a garbled, fragmentary, and incorrect form in some journals and newspapers, together with comments attacking the processes and conclusions. It was well known that, in the circumstances, the witnesses for the Crown were precluded from making any reply or giving any explanation.

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[1] *R.* v. *Palmer*. C.C.C, May, 1856.

In regard to the chemical research for poisons, chemists generally differ as to the process which it may be desirable to pursue in a given case; and although the same result may be reached by various methods, it is by no means difficult to find one who will assert that the only correct process is his own, and that all others are fallacious, or to raise by such counter-statements that element of doubt in the minds of a jury which may lead to the discrediting of a witness's results.

DEPOSITIONS

It is important that a medical witness should remember that copies of his report and depositions,[1] either before a coroner or a magistrate, are placed as a rule in the hands of counsel as well as of the judge, and that his evidence, as it is given at the trial, is compared word for word with that which has been already put on record. The depositions of witnesses before a coroner are, or can be, called for at any stage subsequent to a coroner's inquest, and the written evidence may be read out in court, when discrepancies between the depositions and the present evidence may provide material for cross-examination. There is reason to believe that this is not generally known to members of the medical profession, and thus it happens that either from failure of memory, want of accurate observation, or carelessness in giving evidence at coroners' inquests, medical witnesses may lay themselves open to criticism or even censure by the Judge at the eventual trial.

CORONERS' PROCEDURE

The proceedings at coroners' inquests are treated too lightly by medical men: apparently it is a case where familiarity breeds contempt. The ignorant and uneducated persons who often constitute the jury, as well as the circumstances in which the inquiry often takes place, are not calculated to inspire great respect for these preliminary proceedings; nevertheless by law and by custom coroners' inquests have been for centuries and are still the primary tribunals in England for inquiring into and determining the cause of death in cases of suspected violence; and they are, therefore, deserving of attention. In all inquests which result in the committal for trial of an accused person, a medical man who is giving evidence before a coroner (sometimes in the room of a small inn) is virtually delivering it before a judge of assize; and this fact alone should induce him to give the evidence guardedly, and with a due regard to the serious results to which exaggerations or misstatements ultimately may lead.

The investigation of deaths from violence may be faultily performed through lack of familiarity on the part of the investigator with (*a*) the signs of a violent death, or (*b*) the steps necessary in a medico-legal inquiry. The following matters therefore require special consideration, namely:—The qualifications of the coroner; Procedure; *Post-mortem* examination.

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[1] Depositions, as they are termed, are merely written records of evidence given orally. They should be always read by, or to, the witness before he signs them. It is easy for him to correct any error which may have crept into the document by reason of the ignorance or neglect of the coroner's or magistrate's clerk, who writes down what the deposing witness says. He should see, moreover, that it represents *exactly* what he did say.

Medical practitioners are often in doubt about their legal position in connection with the reporting of deaths to coroners, and it is as well that they should know that they are not required by law as medical practitioners to report any death to a coroner, though obviously there are occasions on which it is most desirable that deaths should be so reported. Similarly, it is no legal duty of a medical practitioner to give information about a death to a coroner's officer, though it may be desirable to do so.

A medical practitioner may carry out the *post-mortem* examination of a body with the consent of the relatives, whether he knows the cause of death or not, provided that by so doing he does not knowingly hinder the coroner in carrying out his duties. When a death has been reported to a coroner no examination of any kind should be made by a practitioner except with the authority of the coroner.[1]

The Qualifications of the Coroner. The Coroners Act of 1887 required that the coroner should be a "fit person"; but by the Coroners (Amendment) Act, 1926, the coroner and his deputy or assistant must be either a barrister, a solicitor, or a legally qualified medical practitioner of not less than five years' standing in his profession. A county coroner is no longer required to have "land in fee."

Inasmuch as in more than half of the cases reported to him the average coroner orders a post-mortem examination and has to decide from the result of the post-mortem examination whether the death is capable of being disposed of without the holding of an inquest, the desirability of the holder of the office being not only a medical man but having an up-to-date medical knowledge, is one worthy of consideration.

Procedure. When a case is reported to him a coroner has a choice of courses according to the information which is supplied. The cases usually fall under one or other of the following heads:

(*a*) If reported to him in fulfilment of a legal duty (as in cases of foster children, persons of unsound mind, etc.) or because of the standing instructions to the local registrar of deaths by the Registrar-General (*e.g.*, where the medical certificate of cause of death is out of date, information of possible injury, etc.), a comparatively simple inquiry may satisfy the coroner that the death is natural and that there is no reason why the medical man who has attended during the last illness should not give a certificate and that certificate be accepted by the registrar. In such case the coroner sends notification to the registrar. and the death is registered upon the medical certificate In all such cases the cause of death is natural and known (or should be known) by the physician and, since it is natural, no inquest is required.

(*b*) Where there is reported to the coroner a sudden (i.e., unexpected) death of which the cause is not known, but the coroner is of opinion that a *post-mortem* examination may prove that an inquest is unnecessary, he may order a *post-mortem* examination to be made.[2] If the *post-mortem* examination reveals the cause of death to be natural, and the coroner considers there is no necessity to hold an inquest (e.g., where there is no complaint by relatives and nothing unusual or strange in the place or circumstances of death apart from its unknown cause, etc.), he again sends information to the registrar of deaths, but unlike the case of (*a*) (supra) he states the cause of death as found by the *post-mortem* examination and the death is registered on the coroner's certificate. This procedure is specifically declared[1] as being no authority for the coroner to dispense with any inquest in any case where there is reasonable cause to suspect that the deceased has died either a violent or unnatural death, or has died in prison, or in such a place, or in such circumstances, as to necessitate the holding of an inquest. Payment is made to the legally qualified medical practitioner who makes the *post-mortem* examination at the order of the coroner; by Statute the fee is two guineas.[2]

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[1] *Medico Legal Review*, 12,33,1944.

[2] Coroners (Amendment) Act, 1926, s. 21(1).

(*c*) The coroner may hold an inquest in any case that is reported to him. He must do so if he is informed that there is lying within his jurisdiction the body of a person and there is reasonable cause to suspect that such person has died either a violent, or an unnatural death, or has died a sudden death the cause of which is unknown (subject to the more recent provisions set out in (*b*) (supra), or has died in prison, or in such place or in such circumstances as to require an inquest in pursuance of any Statute.[3]

Originally all inquests were held by a coroner and a jury : the coroner is now given power to dispense with a jury, if he thinks fit, in certain cases, but a jury must be summoned where it appears to the coroner either before he proceeds to hold an inquest or in the course of an inquest begun without a jury, that there is reason to suspect—

- (*a*) That the deceased came by his death by murder, manslaughter or infanticide ; or
- (*b*) That the death occurred in prison or in such place or in such circumstances as to require an inquest under any Act other than the Coroners Act, 1887 ; or
- (*c*) That the death was caused by an accident, poisoning or disease, notice of which is required to be given to a Government department, or to any inspector or other officer of a Government department, under or in pursuance of any Act ; or
- (*d*) That the death was caused by an accident arising out of the use of a vehicle in a street or public highway ; or
- (*e*) That the death occurred in circumstances the continuance or possible recurrence of which is prejudicial to the health or safety of the public or any section of the public.

In addition, the coroner has power to summon a jury in any other case if it appears to him, either before he proceeds to hold an inquest or in the course of an inquest begun without a jury, that there is any reason for summoning a jury.

Viewing the Body. At or before the first sitting of an inquest on a body, the coroner must view the body, and if, before the body has been buried, the coroner so directs, or a majority of the jury so desires, the body must be viewed by the jury also.[4]

Absence of Body. The normal jurisdiction of a coroner depends upon the existence and view of a dead body within the area for which he is coroner, but there are exceptions to this. Where a coroner has reason to believe that a death has occurred in or near the area within which he has jurisdiction, and that owing to the destruction of the body by fire, or otherwise, or to the fact that it is lying in a place from which it cannot be recovered, an inquest could not be held but for the provisions of the Coroners (Amendment) Act, 1926, s. 18, whereby he may report the facts to the Home Office, and that Department may order the coroner to hold an inquest, subject to the absence of the body and the consequent lack of " view " which is normally fundamental to the holding of an inquest.

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[1] Coroners (Amendment) Act, 1926, s. 21 (3).

[2] Ibid, s. 23 (6)

[3] Coroners Act, 1887, sec. 3.

[4] Coroners (Amendment) Act, 1926, sec. 14.

In a similar manner, by a special war-time regulation[1] the coroner was given an entirely new jurisdiction to inquire into certain deaths that were alleged to have taken place owing to war operations.

Autopsy. An inquest without a careful external and internal examination of the body is a vain mockery. It is not to be implied from this statement that an inquest should be held on the bodies of all persons who die suddenly. Many sudden deaths take place from well-known natural causes easily elicited by a proper medical inquiry, and therefore do not demand a judicial inquiry.

The Non-familiarity on the Part of Ordinary Medical Men with Post-mortem Findings is a matter which affects very closely the medical evidence given before coroners.

By the Act of 1887, coroners have power to call in *any* legally qualified practitioner, and to fine any one £5 who refuses without reasonable cause to act ; but this provision cannot be regarded as entirely satisfactory, for neither in his original training, nor in the ordinary performance of his professional duties (which are concerned with the living only), does the average general practitioner get sufficient opportunity for the study of the complexities and revelations yielded by the *post-mortem* examination of the dead body, and still less for drawing inferences from *post-mortem* findings.

In one case cancer of the gut causing perforative peritonitis was overlooked ; and in another the flexion of the terminal phalanges of the fingers, found in a baby who had been packed in a bandbox for six months, appeared to be strong evidence of death from strangulation. These are perhaps extreme examples of what ought to have been, but were not, within the competence of the practitioner who made the autopsy. There are, however, many facts which can be recognised only after long experience : for example, the difference between certain pathological conditions and changes which occur in the tissues after death ; the difference between bruises and *post-mortem* staining, the difference between the early stages of pneumonia and simple hypostasis of the lung, and the difference between meningitis and a simple distension of meningeal veins. Further similar examples are the estimation of the nature and age of an inflamatory exudation or a blood-clot, and the age of a wound or the means of its infliction.

However desirable it may be that an expert should make the *post-mortem* examination (and the report of the Departmental Committee on Coroners (1936) stresses the importance of coroners having *post-mortem* examinations made in the best possible circumstances), it is important that the practitioner who habitually attended the deceased, or the one who was present during the last hours of life should be called to give evidence at the inquest. An autopsy conducted with the greatest skill and attention to anatomical details may fail completely to yield any satisfactory explanation of the cause of death without the assistance of the *ante-mortem* symptoms which only a practising physician can describe and evaluate accurately.

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[1] Defence (Burial, Inquests, and Registration of Deaths) Regulations, 1942, S. R. & O. 1444, reg. 3.

Under the Coroners (Amendment) Act, 1926, s. 22, there is power for a coroner, at any time after he has decided to hold an inquest, to request a specially qualified medical practitioner to make not only a *post-mortem* examination of the body of the deceased, but also a special examination, by way of analysis or otherwise, of any part or of the contents of the body with a view to ascertaining the cause of death.

Procedure at a Medico-legal Autopsy. It should be made a rule that no unauthorised person should be present at the autopsy. Whereas this practice may lead to some injustice, or may wound the vanity of the practitioner concerned, at all events it ensures the absence of any gross carelessness or of any attempt to obstruct the course of justice.

The Coroners (Amendment) Act, 1926, s. 22 (4), provides that where a person states upon oath before the coroner that in his belief the death of the deceased was caused partly or entirely by the improper or negligent treatment of a medical practitioner or other person, that medical practitioner or other person shall not be allowed to perform or assist at any *post-mortem* or special examination made for the purposes of the inquest, but he shall have the right to be represented at such examination.

Sometimes a charge of malpraxis is raised against a medical man in consequence of the death of a patient. The examination of the body may, by order of a coroner, be placed unwittingly in the hands either of a professional rival or of a friend of the person concerned. This is not just either to the practitioner or to the public. It is very easy, from a medical point of view, to exaggerate appearances in a body, and to assign to the action of medicines, or to the use of surgical instruments, *post-mortem* conditions to which an independent and experienced anatomical inspector would probably attach no importance. Where, for example, there is a question whether a patient has died from an overdose of opium or of digitalis or other ordinary vegetable medicament, and the analysis has been entrusted by a coroner to a practitioner of limited experience, irreparable harm may result. Such cases have occurred, and must continue to occur unless and until specially qualified persons are always appointed to make such examinations in lieu of men selected fortuitously on the ground that they happen to reside in the vicinity or that they were called to attend the deceased immediately prior to his death. Coroners have now power to request specially qualified persons to make *post-mortem* examinations, analyses, tests, etc.

SUBPŒNA

Witnesses, medical and other, are summoned to give evidence, and to produce documents, before all courts, by writs of "*subpœna ad testificandum*" and "*subpœna duces tecum*," which are familiarly known as "*subpœnas*."

Medical men occasionally attend a court, especially that of a coroner, without a *subpœna* ; but such action is very inadvisable, since a medical man's right to his fee depends upon his attending an inquest in obedience to a summons.[1] If a medical man thus attends a civil court without a *subpœna*, he should take care to obtain *in writing* from the person who requests his attendance a satisfactory assurance in regard to his fees. If possible, arrangements should be made for fees to be paid in advance.

Without a *subpœna*, or some written assurance as suggested above, a medical witness is not bound to appear, unless he makes a promise to attend for good consideration ; if he fails to appear under such a promise, he may find himself in a similar position to that of the defendant in *Yeatman* v. *Dempsey*,[2] which was an action brought by a husband who alleged that his wife was insane at the date of the marriage, and where it was held that an action could be maintained against a medical man for failing to fulfil his promise to appear and to give evidence. The plaintiff was awarded £50 damages ; and on appeal it was held that it was not necessary for the plaintiff to show that he would have succeeded in the Divorce Court with the aid of the evidence of the medical man.

If conduct money has been paid to a witness, and his attendance becomes unnecessary and he has incurred no expense, the conduct money is recoverable by the person who paid it ; but a medical witness, served with a *subpœna* for the purpose of giving expert evidence and not merely evidence as to the facts of the case, is entitled to claim compensation for loss of time as well as travelling expenses before giving evidence.[3]

A *subpoena* may be served upon a medical (or other) witness either personally or by post ; and in either case a reasonable sum for travelling expenses is generally tendered with it. In civil cases such tender of expenses is obligatory on the party serving the writ, and if the tender is not made, the witness need not obey the *subpœna*, except under the conditions mentioned above. In criminal cases it appears that at the time of service a tender of expenses is not bound to be made, although in practice it usually is done ; but a medical witness would be well advised always to obey the *subpœna*.

The Subpœna must be Obeyed. Where a *subpœna* is accepted and then ignored or disobeyed, the one who disobeys is liable to attachment by the court so flouted, or to an action for damages by the party serving the *subpœna*.

Attachment by the Court. Before attachment can be effected it must be shown clearly that there was contempt ; that the defaulter was a material and necessary witness, and that he was duly called at the trial. If these formalities are complied with, it is in the power of the court to fine a defaulter or to commit him to prison until he has purged his contempt.

Action for damages. Before such action can succeed it must be shown that the action in which the proposed witness was summoned was duly called on, and that the witness was both material and necessary. But it is not necessary to aver that the witness's absence was the sole cause of the failure of the plaintiff's action ; but there must be actual loss through the witness's breach of duty to obey a *subpœna*.

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[1] Coroners (Amendment) Act, 1926, s. 23.

[2] 7 C.B. (N. S.) 628 and 9 C. B. (N. S.) 881.

[3] *In re Working Men's Mutual Society*, 21 Ch. D. 831.

Advice to Medical Men. All cases in court may be divided into civil and criminal, and all evidence (whether oral or documentary) into that relating to facts, or that consisting of opinions only; and there is no doubt that the law deals more severely with criminal cases than with civil actions, and attaches more importance to *facts* than to opinions.

In science, however, and in the medical sciences particularly, it is always difficult to distinguish between fact and theory; and if a man attends to testify to a medical or scientific fact, he cannot easily avoid giving an opinion arising out of the fact.

If a *subpœna* be sent to or delivered to a medical man, his course of action should in the first place be governed by the nature of the case (criminal or civil) and by the nature of the evidence which it is, or is supposed to be, in his power to give. The matter may be summarised as follows:

When he is summoned in connection with a criminal case, and has facts, including documents, in his knowledge or possession, he must obey the *subpœna*, regardless of the court to which he is called, and whether expenses are tendered or not. The most common case is a summons to a police court; and magistrates have power to compel attendance.

In *Rich* v. *Pierpoint*[1] (an action for malpraxis), Lee was summoned, against his will, to give evidence on the part of the plaintiff. He stated that on the evening before the trial a solicitor called on him and left a *subpœna* with him. Lee would not hear an account of the case which the solicitor proposed to give, and expressed his resolution to have nothing to do with the trial. The solicitor informed him that he would be required to pay the usual penalty if he did not attend. He went to Kingston, and was warned not to leave until the trial was over. He heard the evidence on the part of the plaintiff, and upon this, and the medical evidence, he gave his opinion, not much in favour of the party who summoned him and not much against him.

Where a medical man is served with a *subpœna* in a civil case, in connection with which facts are known by him, he should obey the summons, and give evidence as to the facts. If the solicitor neglect to tender expenses at the time of serving the *subpœna*, the witness should attend, and should leave the question of expenses to be dealt with subsequently

Apart from the foregoing cases, difficulties arise where a medical man has received *subpœnas* to attend trials at two or more courts which are held at or about the same time, and obedience to both or all of them is impossible. On one occasion Taylor was called from a civil trial which had commenced in the Assize Court at Durham to a criminal trial which was fixed to take place on the same day at Lincoln. The civil case was postponed, and in the opinion of one of the most experienced judges on the Bench, in all cases in which there are served separate *subpœnas* relating to trials fixed for the same time the civil case should give way to the criminal case. If, however, the *subpœnas* are for two criminal cases, a witness's best course is to attend the case in which the *subpœna* was served upon him first, and to address to the judge presiding over the second case a letter explaining the circumstances.

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[1] 3 F. and F. 35.

TAKING THE OATH

By the Oaths Acts of 1888 and 1909 a witness is allowed to give evidence without taking the usual oath and without " kissing the book." Unless the witness objects to taking an oath (in which case he may "affirm"), he should be sworn in the usual way by using the following words : " I swear by Almighty God that the evidence I shall give . . . shall be the truth, the whole truth, and nothing but the truth." Even if he profess to have no conscience, the taking of the oath effectually renders him liable to the law of perjury, which, next to the obligation of telling the truth, is the object of the oath.

EVIDENCE

Evidence given before a court is of three kinds : *viz.*, (i.) oral, (ii.) documentary ; (iii.) real. The first mentioned must be dealt with at length, as it is the most common and often the only form in which medical evidence is given.

In the coroner's court, it is the common practice for the coroner alone to ask the medical witness questions bearing on the case ; but, by his permission, any member of the jury or any other interested person may put questions, and these should be answered with fairness and candour. With this exception, the practice in all courts is the same, and a witness usually undergoes the following examinations :

1. Examination-in-chief.
2. Cross-examination.
3. Re-examination.
4. Questions by the president of the court or by the foreman or any member of the jury.

An accused person is always at liberty to go into the witness-box to give evidence on his own behalf.

Examination-in-chief. The ordinary course of proceeding in a criminal case is as follows : After opening the case, the counsel for the Crown calls the witnesses, and examines them according to the rules of evidence—that is, he brings out by questions *which do not suggest their answers* the facts relevant to the issue to be tried which are within the personal knowledge of the witness. When the examination-in-chief has been given, the next step is the cross-examination.

Cross-examination. In this, the second stage, the counsel for the accused seeks to extract from the witness, by leading questions, *i.e.*, *those which suggest the answer in the strongest form*, any facts which may appear to be favourable to his client, and which he believes to be within the witness's knowledge. The theory of the law is that the witness is unfavourable to the side which is cross-examining him, and is therefore hostile.[1] The more he has shown himself, by conduct or conversation, a partisan in the case, the more severely will he be treated. Anything which he may have said in the hearing of others, or published in journals, or even written in private letters (if the contents transpire), with reference to the case or the guilt of the prisoner, is now brought to light, although he may have supposed that what he did say was in confidence. It is at this stage of the case that any exaggerations which may have been most favourably received by the witness's own counsel are reduced to their true proportions. Any bias by which the mind of a witness may have been influenced, or any imperfection or confusion of memory as to facts, is here brought out. It is in this part of his examination that the medical witness will be closely questioned as to his qualifications, the time during which he has been engaged in practice, the accuracy of his judgment, his general professional knowledge, and his special experience with reference to the matter in issue, the number of cases which he has seen, etc. Straightforward answers should be given to all these questions.

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[1] A hostile witness may therefore be defined as a witness who from any motive is reasonably assumed to have an object in concealing part of the truth, or in giving false evidence. Hence the witnesses on the other side are usually hostile, and occasionally one's own witness may be.

In dealing with a skilled witness whose evidence may be of importance, the questions in cross-examination are usually put by the opposing counsel with great caution, for the answers brought out may be more adverse to his own case than those elicited in the examination-in-chief. The most important caution in cross-examination is the use of the phrase "I don't know." If a witness has once used it, let him adhere to it rigidly, and not be bullied by cross-examination into saying "It might have been." Cross-examination sometimes cuts both ways; the following example was once heard at the Old Bailey:

> The witness (who was not a medical man) had asserted that a cyclist was travelling at 30 miles an hour. The cross-examining counsel seized on the point, and endeavoured to discredit the witness; but it appeared that the witness had taken great pains to cultivate his judgment of the speed of vehicles on the road, with the result that the cross-examination only confirmed the recklessness of the prisoner whom the cross-examiner had been briefed to defend.

Re-examination. As a rule, after cross-examination the witness is re-examined by the counsel who called him. The object of this is to clear up or to explain any part of the evidence which may have been rendered obscure or doubtful by the cross-examination. It is sometimes unnecessary to put further questions; and if the witness has given his evidence consistently and fairly, he may be asked no further questions. As a rule, the re-examination must be confined to those matters which have arisen out of the cross-examination. Questions upon new matter may render a further cross-examination necessary. As to *facts*, a medical witness must bear in mind that he should not allow his testimony to be influenced by the consequences which may follow from his statement of them, or their probable effect on the case. As to *opinions*, the possible influence thereof on the result of the case should induce caution in forming them; but when once formed, they should be stated honestly and candidly without regard to consequences. It is well to remember, in regard to each stage of the examination, what a great medical authority has said:

> "To make a show and appear learned and ingenious in natural knowledge may flatter vanity. To know facts, to separate them from supposition, to arrange and connect them, to make them plain to ordinary capacities, and above all to point out their useful applications, should be the chief object of ambition" (William Hunter).

Questions have been raised whether a witness should volunteer evidence where the examination-in-chief and cross-examination have not brought out all that he knows of the case. If that which he has to state is some matter of fact within his own knowledge, or an opinion based on facts within his knowledge, he will be allowed, on application to the judge, to make the desired statement.

Questions by the Judge or by a Juror. There are no rules to govern such questions. The judge has an absolute discretion in putting any question, as well as in allowing a juror to do so; as a rule, however, such questions should be simple, and only such as are necessary to clear up any small and doubtful point, although occasionally very important and far-reaching questions are sometimes so put. In a case of infanticide an Old Bailey judge once put this question: "Then, doctor, you mean there was no evidence of live birth?" "That is so, sir," came the reply, whereupon the judge stopped the case immediately without calling on the defence.

Such is the general method by which oral evidence is obtained, but some details of procedure must be noted.

PRIVILEGE OF COUNSEL

Medical men have sometimes complained of the abuse of the privilege of counsel. On this subject a high judicial authority has said: "The law trusts the advocate with a privilege in respect to the liberty of speech which is in practice bounded only by his own sense of duty; and he may have to speak upon subjects concerning the deepest interests of social life and the innermost feelings of the soul. The law also trusts him with a power of insisting upon answers to the most painful questioning, and this power again is in practice only controlled by his own view of the interests of truth."[1] It would appear, therefore, that almost unlimited powers of interrogation are entrusted by the law to counsel. Counsel should always exercise caution in putting a question. By putting the question he adopts it; although he may do so to the great damage of his own case. This seems at present to be the only check upon the practice; for judges seldom interfere, unless appealed to directly by the witness.

No witness is ever compelled to appear and testify to what he does not know. He may be compelled to attend in court in obedience to a *subpœna*; but if he attempts to give evidence as to technical matters upon which he has no clear views, he has only himself to blame if things go wrong. A country practitioner of twenty years' honourable practice in his district may be called suddenly to a case in which a man is found dead from a wound in the throat. Under the Coroners Act he may be compelled to make an examination of the body for a coroner's inquest. At great loss of time, and for no adequate remuneration, he attends the inquest, gives his evidence, and is bound over, *nolens volens*, to appear, for the first time, as a witness at a criminal trial, and (i) to testify to the fact that the throat was cut, and (ii) to state his opinion (*a*) as to the cause of death, and (*b*) whether the wound was inflicted by the deceased himself or by another person. A medical man who confined himself to the statement of the bare fact that the decreased's throat was cut need not appear at all, unless *subpœnaed*, for this evidence could be given by the police; but the law assumes from his profession that the medical man made a proper examination of the wound, with a view to determining whether it was the cause of death, and whether it was or was not self-inflicted. It is difficult to understand how a medical man, although before this occurrence he may never have seen a case of cut throat, could excuse himself from giving answers to these questions, both of which involve purely matters of opinion. If he excused himself altogether from giving answers, there would be a failure of justice, and no conviction for such a common form of homicide could ever take place. In medical evidence, facts and opinions cannot be entirely separated; and if medical practitioners were restricted in their evidence only to those facts which they observed in a case where no other professional man saw the person living or dead, crime would sometimes go undetected. These remarks, of course, do not apply to cases in which the opinions of medical experts can be taken.

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[1] *Per* Erle, C. J., in *Kennedy v. Brown*, 1862.

Assuming that the witness is properly prepared for the discharge of his duties, and that the questions put to him are answered fairly and truly, according to his knowledge and experience, without exaggeration or concealment, he has nothing to fear from severe cross-examination.

QUOTATIONS FROM BOOKS

A medical witness may reasonably be expected to have a fair knowledge of the writings of professional men on the subject of inquiry; and, during cross-examination, counsel refer occasionally to medical works. The authority is mentioned, the passage is quoted, and the witness may then be asked whether he agrees with or differs from the views of the author. If he differs therefrom, he is generally asked to state his reasons therefor. In cases connected with medical treatment, the views of the profession are so various that a barrister has no great difficulty in finding a book containing opinions which differ from those of the witness. Standard works of recent date are so well known to the profession that there are few medical men engaged in practice who are not acquainted with, and are able to explain, the views of the writers, and who are unable to state how far such views agree with or differ from their own. The witness must be on his guard that the quotation is properly taken with the context, or he may find himself involved in a difficulty. If the witness is not already acquainted with the work, he should always ask to see the book in order that he may ascertain whether the passage is correctly or fully quoted.

Without suggesting deliberate misrepresentation, a barrister when dealing with the medical facts may misunderstand the author's views and statements, and may incorrectly assign to the author opinions which he has merely quoted from other authorities for comment or illustration.

MEDICAL PRIVILEGE OR PROFESSIONAL SECRECY[1]

Some medical men have claimed a privilege not to answer certain questions which are put to them in a court of law, on the ground that the matters have come to their knowledge through private and confidential communications with their patients. The law concedes no such special privilege of this nature to members of the medical profession. No man is bound to reply to any question if the answer would tend in any way to incriminate himself, for no man is compellable to be a witness against himself. With this exception, all questions must be answered, provided they are relevant to the case ; and their relevancy is a matter for the decision of the judge. Sometimes a witness makes a frivolous objection and refuses to answer an ordinary question. The only result is to bring ridicule upon the witness.

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[1] In March, 1922, the Medico-Legal Society devoted two evenings to the reading and discussion of a paper on this subject by Lord Dawson of Penn. Reports appeared in the *Lancet* on April 1st, 1922, and in the *B.M.J.* on March 25th and on April 1st, 1922.

At an important trial an expert witness was asked his age. Instead of answering this simple question at once, he angrily appealed to the judge to know whether he was bound to give an answer on a matter which, he asserted, could have nothing to do with the case. The judge informed him that, unless he had some very strong reasons for concealing it. he had better state it. At a trial for murder by poison, in the course of cross-examination, counsel for the prisoner asked the medical witness what remedy or antidote he had employed when he was first called to attend the deceased. He appealed to the judge to know whether he was bound to answer such a question as that. The judge said : " Yes, unless you have reason to believe that your antidote killed the deceased. In that case you are not bound to answer it." The question was answered immediately.

As there is no special privilege granted to members of the profession, a witness must remember that there are no medical secrets. In the case of the *Duchess of Kingston*[1] this privilege of withholding statements was claimed by a medical witness, but was not allowed by the court. In a case in which a woman was indicted for the murder of her infant, a surgeon was called to prove certain confessions made to him by the woman during his attendance. He objected to giving such evidence, on the ground that he was then attending her as a private patient. The judge ruled that this was not a sufficient reason to prevent a disclosure for the purposes of justice, and the witness was ordered to answer the questions.

Two sisters were servants to an old lady. One of them became pregnant, miscarried, and was attended by a surgeon. The mistress, who knew all about the matter, retained the girl in her service, and left her a legacy at her death. The will was disputed by the heir-at-law on the ground of undue influence ; and at the trial, in order to injure the girl's character, the surgeon was called, and asked for what illness he had attended her some years before. Believing that he had a privilege, he refused to answer, but it was decided by Kindersley, V.-C., that he had no privilege, but was bound to tell all he knew. This decision resulted in a loss to the surgeon of 30*l*. for costs.

In criminal cases the same point has arisen several times ; and it has even happened that the reply made by the accused to a question asked by his physician has been the only evidence upon which a conviction could be based. It will be perceived, therefore, that any statements which are made to physicians or surgeons while they are attending persons in a private capacity, although such statements are not to be volunteered in evidence, must be given in answer to questions, whatever may be the consequences. Cases of poisoning, of wounding, and of duelling, as well as cases which involve questions of divorce or the legitimacy of offspring, may be affected materially by the answers of a medical man on matters which have been the subject of private communications.

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[1] 20 State Trials, 355, 537.

The law of England on this important subject undoubtedly conflicts with the law of honour sought to be observed by medical men (from a breach of which more than one has suffered severely), *viz.*, that information obtained in the consulting-room from patients relative to their ailments must be held to be inviolably secret.

In any case, however, where a medical practitioner is informed by a patient that a serious crime has been committed, it is his duty *at once* to communicate with the police.

The following case illustrates the difficulties in which a medical man may be placed by his peculiar confidential relations with his patients :

> An unmarried girl gave birth to a male child. The physician succeeded in placing it out, and a sum of 500*l*. was paid with it. Before his death the physician told his son, who succeeded him in the practice, the whole circumstances of the case. The foster-mother took to drink, and the illegitimate son proved himself to be a "degenerate." He discovered from his foster-mother that he was not her own son, and also that the physician knew who his mother was. In his efforts to obtain, by threats, the name of his mother a free fight arose, and the son took out a summons for assault against the physician and foster-mother. At the hearing of this summons, the magistrate demanded to be informed of the name of the mother, which the physician refused to give ; but, in consequence, he lost his case.

Dr. Dixon Mann[1] says : " A good citizen obeys the law, although he may have scruples in doing so ; therefore a witness should not set his private judgment against authority without very searching self-inquiry ; an obstinate conviction must not be mistaken for a sense of duty. In the majority of cases it will probably be compatible with his sense of duty if the witness enters a protest against answering the question and then bows to the requirements of the law."

It is clear from the requirements as to the notification of infectious diseases contained in Part V of the Public Health Act, 1936, that medical secrecy is not recognised by law. By that statute the medical man is compelled to disclose not only the fact of illness, but also the exact nature thereof.

Venereal Diseases Clinics. In the case of *Garner* v. *Garner*,[2] the question was raised as to the obligation of a medical practitioner to give evidence of facts which have come to his knowledge while attending a patient at a venereal diseases clinic. The report of the case shows that it was at the patient's own instance, and on her behalf, that the physician who had attended her was called to give evidence as to her state of health. The physician drew the attention of the judge to the Venereal Diseases Regulations of July 12th, 1916, which required all information acquired by a medical practitioner in the course of his duties at a venereal diseases clinic to be regarded as strictly confidential ; but the learned judge ruled that the witness was nevertheless bound by law to answer the questions put to him.

In the circumstances the case was not one in which any question of the violation of professional confidence arose. In regard, however, to the Venereal Diseases Regulations, the Ministry of Health has been advised that the obligation which the Regulations impose on the medical practitioner is not to disclose to third parties any facts which his examination of the patient may have brought to light. It would seem that a disclosure at the express request of the patient and in the patient's own interests would not be contrary to any principle of medical ethics.

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[1] "For. Med.," p. 7.

[2] 36 T.L.R., 196.

The Venereal Diseases Regulations do not purport to, and indeed cannot, override the general law of England, which requires a witness in a court of justice to answer all such questions as the judge may hold to be relevant to the issue before the court.

Closely associated with this subject is the giving of **certificates of illness.** Very much depends upon whether the practitioner is acting as a medical *officer* or only as a medical *man.* In the former case, it is, as a rule, a term of his appointment that he will give such certificates when acting for his employers ; furthermore, those for whom the certificates are given know also that they will be given and read ; and, therefore, a medical man is, in these cases, bound to complete a certificate accurately and precisely, stating the exact nature of the disease. The foregoing statement answers the following inquiry and many others of a similar nature which appear from time to time in the medical press.

> "An engine driver came to consult me about an ordinary catarrhal ophthalmia, but in addition to this, I found unequal Argyll-Robertson pupils, absence of knee-jerks, and other slight symptoms of tabes, and possibly early G.P.I., tremulous tongue, nervousness, and some excitability, etc. Apart from this he was quite well and able to do his work. Would I be justified in reporting him to the railway company to prevent his working, as he himself did not see any reason why he should not do so ?"

Again, some workmen's clubs will not give sick pay when incapacity arises from venereal disease. In such cases the medical officer must not in his certificate suppress the facts ; there can be no question here of professional secrecy.

In private practice, many cases of difficulty may arise which require great nicety of judgment, of which the following is an example :

> A child had interstitial keratitis, and a medical man was requested to give a certificate stating that the child could not attend school. The certificate required the nature of the illness to be stated. He refused to do this, but gave a general certificate to the effect that the child was not fit to attend school. As this was deemed insufficient by the school authorities, the mother was summoned. The medical man appeared as a witness for her in court ; but he still refused to state the nature of the illness, and said that the child had an affection of the eyes. This action on the part of the school authorities was expensive to the ratepayers.

Certificates of incapacity to attend to public duties, such as serving on a jury, are often given far too readily. A medical man should remember that in regard to such matters the physician's reputation for honesty must not be forgotten. He is in a position of trust and responsibility and should act accordingly.

In this connection it should be remembered that a certificate given by a medical man in response to the request of a private patient may possibly be used in judicial proceedings, and the physician may be called upon to swear as to its correctness. His position would be very unenviable if he had subsequently to admit that the certificate was not correct.

In regard to the propriety of inserting in such a private certificate the precise causation (venereal, traumatic, etc.) of some symptomatic disease such as rheumatism, each case must be judged on its merits by the practitioner's standard of conscience and duty. On the one hand, it has to be remembered that the document is the private property of the holder, to be used or destroyed according to his discretion; on the other hand, the physician's reputation for honesty must not be forgotten.

The following case is in point:

A physician was called into consultation in 1916 regarding the acute illness of a man who did not wish to serve for military duty. The trouble was gonorrhœal arthritis; and this was stated on the certificate, and, on appeal, the physician refused to delete the word "gonorrhœal." This refusal was based on two grounds: (1) public policy; in that if properly treated, gonorrhæal arthritis was perfectly recoverable, and the man could serve when he recovered; (2) the physician's own reputation, inasmuch as certificates of "rheumatism" are too readily given and are too vague to be of any use.

ADVICE TO MEDICAL WITNESSES

Some medico-legal writers have considered it necessary to formulate rules respecting (*a*) the manner in which a medical witness should give his evidence, (*b*) how he is to act on cross-examination, and (*c*) in what way he is to recover himself on re-examination. Any advice upon this head appears to be superfluous, inasmuch as experience shows that these rules, like those given to prevent drowning, are invariably forgotten at the very moment when the person concerned is in the situation when he requires them most. A man who seeks to the best of his ability to testify to the truth should bear in mind two things: (i) That he should be well prepared on all parts of the subject on which he is about to give evidence. Let him remember on these occasions the advice contained in the Latin motto, *Ne tentes, aut perfice.* (ii) That his demeanour should be that of an educated man, and suitable to the serious occasion upon which he appears, even although he may feel annoyed or irritated by cross-examination. A medical witness ought not to evince any resentment because his professional qualifications, his experience, his means of knowledge, or the grounds for his opinions are investigated very closely: rather he should prepare himself to meet with good humour the attempts of an opposing counsel to involve him in contradiction, and he should show, by his answers, that his sole desire is to state the truth. Law and custom have long established that a barrister, when defending a prisoner charged with murder, is entitled to make use of all fair, and even what may appear at the time to the witness unfair, means for the defence. Nothing can tend more to lower a witness in the opinion of the court and of the jury, or to diminish the value of his evidence, than the manifestation of a disposition to regard his examiner as if he were a personal enemy, to evade the questions put, or to answer them with flippancy or with anger. All such exhibitions end invariably in the discomfiture of the witness. It has been suggested that medical men upon these occasions might learn a lesson from lawyers, and observe how little they allow forensic differences, which they put on with their professional costume, to influence them in their intercourse with each other, or with an adverse judge.

The following rules should be borne in mind, as they may result in the avoidance of many awkward positions.

1. *Have the subject-matter clear in your own mind.* An expert witness must be able to make the subject upon which he gives an opinion clear, and to give satisfactory reasons for this opinion. He must be able to satisfy others that he is master of the subject. Unless he has looked at the subject before with a purpose to understand it, comprehending its extent, weight, and relations, he will find it has suddenly assumed an importance he had not suspected just at the time when the discovery will add to his confusion. Unless the subject is clear in his own mind, his account of it will be confused and unsatisfactory. Every man should submit himself rigorously to this test before entering the witness-box. The case should be viewed from all possible aspects ; and, if an opinion has been formed, it should be dealt with and criticised as if it were that of an adversary. As in controversy, a disputant should put himself as much as possible into the position of his antagonist and endeavour to see the question from that point of view.

2. *Give* DIRECT *answers to simple questions, and answer the question asked, whether the question be asked by your own or by the opposing counsel.* Medical witnesses are liable to forget that direct answers are necessary, and to give answers to questions which are floating in their own minds, or which they think are likely to be put to them. Some witnesses are also disposed sometimes to anticipate many questions by giving one general answer. This merely creates confusion ; and the witness will be told by counsel to keep to the question, and that the other matters will be dealt with later.

Most of the questions put by counsel in cross-examination will admit of an answer " Yes " or " No." If, from the ingenious or casuistical manner in which the question is framed, the witness feels that the simple affirmative or negative might mislead the court, then, after giving the answer, he should appeal to the judge to allow him to qualify it, or to add to it any matter within *his own knowledge* and which is relevant to the case. The witness must remember that he takes an oath to state the truth, *the whole truth*, and nothing but the truth. On the other hand, while the opposing counsel is bound not to introduce falsehood, his sole object is *not* the discovery or development of truth. Unless the witness is on his guard, he may find that when the learned counsel who has cross-examined him addresses the jury his affirmatives and negatives may be worked into a shape representing the reverse of what he intended.

Some witnesses have a habit of not answering the question which is asked, but one which is not asked. In regard to this practice, which arises, as a rule, from a lack of proper attention to the question, a judge once said : " When a witness does not answer a question, but answers something else, it leads persons accustomed to courts of justice to believe that he prefers not to answer the question, but to put a different point upon counsel."

Some witnesses begin to answer before the question is completed ; or are concise from a fear of saying too much, whereas the answers of others are given in a voluble form, *i.e.*, in the form of a little speech or lecture. A witness who is so profuse of information generally succeeds in supplying abundant matter for a long and tiresome cross-examination.

When a professional witness is giving evidence as to his opinion, it is not perjury for him to say " it was so-and-so," even if the contrary be proved by weight of counter-evidence; for the nature of his evidence is only *his opinion.*

No opinion should be given for which the witness is not prepared to assign reasons; and, except by permission of the court, no medical opinion should be expressed on facts or circumstances observed by others. A hesitating witness will be met with the question, "Have you any doubt about it?" or "Was it so or not?" to which a reply in the affirmative or negative must be given. If the witness fairly entertains doubts about the matter at issue, it is his duty to express them at once, and not to allow them to be extorted from him piecemeal by a series of questions.

Chemical witnesses have occasionally testified to the discovery of "imperceptible," "unmistakable," or "undoubted" traces of poison in the liver and in other organs. Such terms naturally convey to the mind of the cross-examiner that the witness has some lurking doubt or suspicion of mistake in his mind. If poison has been discovered, the statement of the fact is sufficient.

3. *Beware of double or involved questions.* Sometimes counsel will compress two or three questions into one. In order to avoid answering the last question, or that which attracts his attention most, a witness should ask for a severance of the questions, and should give separate replies.

4. *Don't argue with counsel.* Argument is not evidence; and the entering into it disturbs the order of the proceedings. Arguments between counsel and witnesses, and even between medical witnesses themselves, are freely allowed in the French courts, but in England there is no such practice. The way in which questions are put by counsel in cross-examination sometimes tends to the introduction of argument, but the witness should avoid the temptation to enter into it. What he says in such circumstances is not evidence, except in the form of answers to questions; and he is there only for the purpose of stating what is relevant to the case.

Inasmuch as the judge is present to ensure, as far as possible, not only that the work of the court shall proceed with due order and decorum, but also that justice should be done to all, including the witnesses as well as the prisoner, a medical witness should appeal to the judge in every case where he considers that he has been asked an unsatisfactory question. The judge is the arbiter of what is and what is not fair, of what is and what is not evidence, of what questions the witness must and what he need not answer.

5. *Speak slowly, audibly and distinctly.* The jury must be able to hear clearly, and some of the jurors may be making notes. A judge generally takes full notes of the medical evidence; he has first to hear, secondly to understand, and thirdly to write down, the replies of the witness.

6. *Give your replies, as far as possible, in simple, non-technical language.* Some observations have been made above in regard to the use of technical terms in drawing up medico-legal reports. The unnecessary use of technical phraseology should be avoided. A medical witness should remember that when he is giving evidence he is speaking in the presence not of a medical assembly but of a jury of plain men and women who are probably ignorant of the meaning of many medical terms.

On a trial for an assault which took place at assizes some years ago, a medical witness informed the court that, upon examining the prosecutor, he found him suffering from "a severe contusion of the integuments under the left orbit, with great extravasation of blood and ecchymosis in the surrounding cellular tissue, which was in a tumefied state. There was also considerable abrasion of the cuticle." *Judge :* "You mean, I suppose, that the man had a black eye ?" *Witness :* "Yes." *Judge :* "Then why not say so at once ?"

In a case of child-murder a medical witness, who was asked to state simply the cause of death, said it was owing to "atelectasis and general engorgement of the pulmonary tissue."

If such language is employed by a medical witness with the view of impressing the court with some idea of his learning, it wholly fails of its effect.

7. *Avoid exaggeration.* The use of exaggerated language often leads to apparent conflict in medical testimony. If a part of the body is simply inflamed, it is frequently described by medical men as "intensely" inflamed. One witness may speak of "patches of ulceration" in the intestines ; whereas another may describe the same condition as "extensive ulceration."

A report could first be drafted roughly, and then corrected by striking out about ninety per cent. of the qualifying adjectives and adverbs.

8. *Never lose your temper* A barrister may sometimes try to make a witness lose his temper, in order to tempt him while in such a condition to make a rash or hazardous statement.

MEDICAL EXPERTS

So far as regards the value of expert opinion in the coroner's court, the remarks on p. 14 are a sufficient exposition of the matter. There is a general consensus of opinion that only experienced pathologists should perform such autopsies, and that they should be adequately remunerated therefor.

In criminal cases, and particularly in civil cases, the subject of expert medical opinion is of greater importance, and requires much consideration.

In questions of legitimacy or of divorce, obstetricians of high standing are consulted on both sides ; in cases of insanity, those physicians who have acquired a reputation in the treatment or observation of the insane are chosen as witnesses ; in cases of accident and of life insurance, surgeons of repute and distinguished physicians are sometimes summoned as expert witnesses. Many of these cases could not possibly be settled without this collateral aid, inasmuch as the questions at issue are determinable only by persons of specialised experience.

The court has power to order that no more than a specified number of expert witnesses may be called. It is seldom that more than two are allowed in accident cases, although as was pointed out by du Parcq, L.J., in *Proctor* v. *Peebles*[1] there should not be a hard and fast rule, as in some cases the medical evidence must be all-important as to the nature and extent of the injuries sustained.

When invited to give evidence as an expert a medical man should arrange for a qualifying fee to be paid in any event, as the taxing master does not usually allow a very substantial fee when the fees are taxed after the case is over.

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[1] [1941] 57 T.L.R. 375

The more common objections to the expert medical witness appear to be the following:

An expert may be biased. Cockburn, C.J., in commenting upon expert evidence, observed that it was in the nature of things that those who gave scientific evidence should lean slightly to the side upon which they were giving their testimony, not from any dishonest intention, but from a perfectly natural and human failing, as in such cases a man was apt to look with a keener eye on those things favourable to his own side than on those which were unfavourable.

Bovill, C.J., said: "The great misfortune or defect in medical testimony hitherto has been that medical men, like many other professional men, have been too much in the habit of making themselves partisans in endeavouring to support the particular views of the parties on whose behalf they have been called, and this has led to conflicts of opinion which have sometimes appeared not very creditable to the profession."

Lord Hatherley thus expressed his views on the subject: A witness to facts knows that it would be base beyond measure to bend his evidence so as to suit the case of him on whose behalf he is called, and that his only duty is to state plainly without colour or fencing what he knows as a *fact*. But the witness who gives an *opinion* is selected by the litigant after communicating with many of the same profession as the witness, and when so selected he is expected to express a particular opinion."

An expert may act as medical adviser. Some barristers obtain the services of medical men to advise them on the best method of cross-examining medical witnesses. Such advisers do not always go into the witness-box, and therefore cannot have their knowledge or experience adequately tested.

In addition to the fact that a practitioner who acts solely as medical adviser may have undue weight given to his suggestions by reason of their being put by his counsel as ascertained medical truths, he escapes that searching examination into his competency which is infallibly the lot of a medical witness; moreover, the latter is bound by his oath to state the *whole* truth, whereas the former is obliged to impart only so much of the truth as may suit the case of the party for whom he appears. In short, his position may be similar to that of a barrister who is not an advocate of any abstract principle of justice, but of the cause of his client How far a medical man has a moral right to make use of his professional knowledge in order to embarrass the testimony of those of his professional brethren who are compelled by law to appear and to give evidence to the best of their ability on the other side is an ethical question which it is unnecessary to consider here. There can be no doubt, however, that, whereas in some instances the practice may work well by preventing convictions based upon erroneous opinions, it is liable to be abused.

An expert has little or no opportunity for altering his opinion when fresh evidence is produced. An expert may honestly entertain a certain opinion when first consulted. The scientific witness who gives evidence for one of the litigants is generally expected to support his case under cross-examination, when many views may be suggested which may modify the witness's opinion ; but even after proof of facts which ought to modify it the witness frequently adheres to his original opinion. Every witness should eschew altogether the notion of partisanship. He should be prepared to give his opinion frankly and unreservedly, regardless of results. He is there not as an advocate, but in order to inform the court to the best of his ability.

If, after hearing all the evidence, a medical witness finds the complexion of the case altered, and that he can no longer support the party calling him, it is his duty to himself and to his profession, as well as to the public, to withdraw from the case. No man should ever appear in court to support that which he does not believe to be true.

Baly, Munro, Wood, and Taylor were consulted in a case of alleged insanity. They insisted upon being allowed to make a full examination of the alleged insane person : the result was that their opinion was completely adverse to the views of those who consulted them. Much to the disappointment of those who consulted them, they declined to give evidence in the case.

The present system leads to conflicting medical evidence. The conflict of opinion among medical witnesses and medical experts is a frequent subject of discussion by the public. In actions which involve the rights and duties of the clergy, there is seldom agreement among those who as ecclesiastical authorities have to decide upon them. It is similar among members of the legal profession, and in the administration of justice generally. Not only do barristers frequently differ, and give conflicting opinions upon the same facts, but special jurors, consisting generally of intelligent men, are often unable to agree upon their findings, and have to be discharged without a verdict. The fact that the venal evidence of " hired " experts or witnesses occasionally finds its way into a case does not justify the sweeping denunciation of medical or scientific witnesses as a body. As Mr. Justice Stephen said of the law, so it may be said of medicine,

> " no system of rules can fully embody that line of conduct by the observance of which those who exercise a noble profession with honour and credit are distinguished from those who disgrace it. It is purely a matter of sentiment and good feeling ; and it is truly a sad day for science, as one judge remarked, when the conflict of opinion may be traced to the ignoble motives of a desire of gain or of notoriety, or of anything but a desire for truth."

In civil cases it is not always easy to determine, until the evidence has been heard in court, whether scientific opinion is in favour of the plaintiff or of the defendant ; and herein lies the great advantage to be gained by taking the opinion of scientific experts employed as assessors. There may be on each side a portion of the truth which will receive medical support without any imputation of wrongful motive. Nevertheless there are some simple matters of fact in regard to which members of the medical profession ought not to be in disagreement. An illustration is afforded by the fracture of a bone, the fact of which an X-ray photograph can prove beyond dispute.

The proper duties of Experts. Men of acknowledged skill and good professional experience sometimes forget their proper duties as experts. An expert is usually called to give an opinion on statements made by other witnesses ; thus where certain appearances have been seen in the stomach or brain, the expert may be asked to state the conclusions to which such appearances lead. A general practitioner may describe accurately what he sees, but he may not have had sufficient specialised experience to draw a correct conclusion. Certain symptoms may be described which an expert may declare to be or not to be consistent with poisoning; but he must take care that he does not alter or distort the facts deposed to by other witnesses in order to fit into the case his own theories or opinions.

The duty of Experts in trials for malpraxis. Upon such occasions a witness is under a duty, when replying to questions by counsel, clearly and distinctly to state his opinion, together with the grounds upon which such opinion is based. It may be hard to condemn a brother practitioner, but it would be harder still to ignore the public interest, and to condemn oneself and one's profession by concealing that which one knows to be true, or by suppressing what one honestly believes. A medical witness is under no duty to be urgent in pointing out or in suggesting defects, or in endeavouring to discredit another practitioner in the opinion of the public; but nothing should be concealed which is relevant to the elucidation of the case in issue. The golden rule, "Do unto others as you would that they should do unto you," should be strictly observed upon these occasions.

OBSERVATIONS ON MEDICAL EXPERT EVIDENCE

It is obviously impossible to exclude from a case all conflicting and bad medical evidence, inasmuch as either party may with reason feel aggrieved if he is not allowed to produce in court expert evidence in support of his case.

Medical experts should always be men of acknowledged reputation in the profession, not young in years or in experience, and should include among them a large proportion of present or past teachers in medical schools who, from the nature of their duties, must keep themselves abreast of the discoveries of advancing medical science, and must be acquainted with new ideas.

Under the law relating to the care and treatment of persons of unsound mind, visits to institutions and to patients in single care are made throughout the country by barristers and physicians associated in pairs, the one trained in the investigation of law and facts, the other in the diagnosis of disease. This has worked admirably. In cases of alleged unsoundness of mind the presence of one or more of the physicians of the Board of Control, sitting with the judge and jury, would be of more value than the evidence of a hundred ordinary medical men.

In regard to actions for damages in respect of injuries caused by railway accidents, it is enacted by the Regulation of Railways Act, 1868, s. 26, that—

> "whenever any person injured by an accident on a railway claims compensation on account of the injury, any judge of the court in which proceedings to recover such compensation are taken, or any person who, by the consent of the parties or otherwise, has power to fix the amount of compensation, may order that the person injured be examined by some duly qualified medical practitioner named in the order, not being a witness on either side, and may make such order with respect to the costs of such examination as he may think fit."

Under the Arbitration Acts 1889, and 1934, the parties in a dispute may select an arbitrator; or each may select his own arbitrator, and these two arbitrators may then agree upon an umpire, in which case a tribunal is constituted which has power to call witnesses and to hear evidence. The particular advantage of such a tribunal lies in the fact that the three presidents, all of whom may be experts, allow the witnesses to be as technical as they wish. During the arbitration, technical terms may be used which are as familiar to the tribunal as to the witnesses, and the tribunal is able to decide the issues with a reasonable prospect of arriving at a just conclusion.

In the opinion of many this is a satisfactory way of disposing of civil cases in which medical evidence is the chief, if not the only, evidence upon which the decision must depend.

Under the Workmen's Compensation Acts, 1925 to 1943, medical referees are appointed to each county court in England and to each Sheriffdom in Scotland.

Sect. 38 of the 1925 Act provides for the appointment of legally qualified medical practitioners to be medical referees for the purpose of these Acts.

If there be a dispute as to medical facts between the employer and the workman, *i.e.*, between the medical man acting for the workman and the one acting for the employer, the matter may be referred to a medical referee. The medical referee to whom the matter is so referred shall, in accordance with certain regulations, give a certificate as to the condition of the workman and his fitness for employment, specifying where necessary the kind of employment for which he is fit, and that certificate shall be conclusive evidence as to the matters so certified.

Refusal to see the referee or obstruction to an examination entails suspension of compensation.

The First Schedule to the 1925 Act, par. 5, enacts that " a judge of county courts may, if he thinks fit, and shall, if any party, in accordance with rules of court, so requires, and gives security for the payment of the prescribed fee, summon a medical referee to sit with him as assessor."

DOCUMENTARY EVIDENCE

Documentary evidence in courts of law consists (*inter alia*) of :—

1. *Letters, Affidavits, Plans, etc., etc.*, with which the medical witness has absolutely nothing to do. These are purely matters of law, and need no comment here.

2. *Notes and Depositions*, about which sufficient has been said *supra*.

3. *Dying Declarations.* These are the deliberate statements of a person who is actually dying (*moribundus*, not *moriturus*). Very frequently a medical man is responsible for obtaining such statements; for example, in accidents where death ensues rapidly. In those cases which prove fatal at some more distant period it is a medical man's duty to see that notice is given to the legal authorities in order that proper attention (presence of witnesses, etc.) may be given to the matter; moreover, it is his duty also to make a note of the mental as well as of the bodily condition of the patient at the time when the dying declaration is made.

The following rules apply in regard to the admissibility of dying declarations :

1. They can be used only in criminal cases.
2. They can be used only in trials for homicide in which the death of the person who made them is the subject of inquiry.

3. They can be accepted as evidence only as to the actual circumstances of the death, and for nothing else.

4. A dying declaration may be made orally or in writing, but, if the former, it must be written down by the person receiving it, either at once or as soon afterwards as possible; and also, if possible, it must be read over to the dying person and signed by him; or his assent and agreement must be obtained in some way.

5. The person making the declaration must be actually dying (*moribundus*, not *moriturus*).

6. He must *believe* that he is dying: but he need not believe that death will ensue immediately.

7. He must have no hope of recovery, and must *believe* recovery to be impossible.[1]

The fundamental principles upon which these rules are based are as follows: (*a*) It is obvious that, inasmuch as no cross-examination can take place on a dying declaration, it must, if admitted as evidence at all, be admitted as it was made; hence the law regards a dying declaration with a very jealous and scrutinizing eye because it is an exception to the important rule that there must be an opportunity for cross-examination. (*b*) The law assumes that no one would willingly leave this world with a lie on his lips; that, under the sense of impending dissolution, all interest in this world is removed; and that the near contemplation of death has at least as powerful an effect upon the mind as the solemn obligation of an oath. A dying declaration, if accepted, must be assumed therefore to prove conclusively the credibility, at the time, of the person making it; the belief must be accepted, but it is open to counsel to argue and to attempt to prove that this belief was wrongly founded.

Such being the case, it is comparatively easy to state the law as to what is the duty of a medical man when called to the side of a patient who may have been criminally assaulted, and who he believes will die soon.

Duties of a Medical Man in regard to Dying Declarations

1. He must inform the patient, as kindly as possible, that he is dying, and should ask him whether he wishes to make any statement. To tell the relatives is not sufficient. If the patient declines to make a statement, the medical man may then urge upon him the importance and advisability of making a statement, pointing out to him what use may be made of it in defending the innocent or in punishing the guilty. It is impossible to lay down any hard and fast rules; every practitioner must use his own discretion. If the patient desires to make any statement the medical man must then—

2. Observe very carefully the mental condition of the patient. When death takes place from violence, especially when loss of blood or a blow on the head is leading to death, delirium often supervenes or the intellect of the dying person becomes confused. If, therefore, the medical man observes any wandering or want of clearness in the mind of the patient, he must bear it in mind and should mention it in connection with his evidence; but this does not absolve him from the next duty, although

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[1] *R.* v. *Perry* (1909) 2 K.B., 697 and *R.* v. *Austin*, 8 Cr.A.R., 27.

it should make him particularly careful when writing his notes. It is necessary also to elicit from the patient what is his own opinion of his condition—whether he himself believes that he is dying, or whether he has some expectation of recovery.

3. The patient's statement should be written down immediately, or at the earliest opportunity after it has been made in the identical words used by the patient, carefully avoiding the practitioner's own interpretation of them or any paraphrases. The longer the interval which elapses between the time of hearing the words and the time of writing them down the greater is the possibility of error. If possible the declaration should be signed by the patient and by witnesses who can vouch for its accuracy.

4. In no circumstances should leading questions be put, and, if at all possible, the questions asked, as well as the answers received, should be written down. As a rule, questions should be directed only to explaining what may appear ambiguous or contradictory in the statement of the patient.

5. In cases of longer standing, that is to say, where the patient has been ill for some time as a result of a criminal assault, it is the duty of the medical attendant to inform the police that the patient is dying, and to allow them to take the steps necessary to have any statement which the patient may wish to make taken down, signed, and witnessed in due legal form.

6. It is not his duty to form a judgment on the admissibility or otherwise of the declaration, provided he has noticed the mental condition as above; he must produce the statement just as it was made, and must leave it to the court to decide the question of admissibility.

In all cases where a medical man perceives that the recovery of a wounded person is impossible, he should take the earliest opportunity for stating this opinion to the wounded person in the presence of others, so that the ends of justice may not be defeated by reason of the non-observance of these legal requirements.

In *R.* v. *Jenkins*[1] the prisoner was charged with the murder of a woman, who, on her death-bed, accused him of the crime. A magistrate's clerk attended her to take down her statement, writing down that it was made "with no hope of my recovery." He then read it over to her; but, before she signed it, she desired the addition of the words "at present," so that the words read "with no hope at present of my recovery." It was held that such statement could not be received in evidence, as her objection to signing the statement without the words "at present" suggested some faint hope of recovery.

In *R.* v. *Morgan*[2] the wound was serious but no actual fear of immediate death was expressed by the victim. Death was caused by the prisoner cutting the throat of the victim. About five minutes before his death and when actually dying the victim made the declaration in writing, having at the time no power to speak. This was proved by a witness who saw the victim come staggering out of a hut with his throat cut. The declaration was admissible.

In *R.* v. *Abbott*[3] a woman who had taken poison, and who in the opinion of the physician was unlikely to recover, repeatedly ejaculated, while suffering great pain, "I'm dying." It was held that this did not conclusively show a fixed and settled belief in her impending death.

In *R.* v. *Ashton*[4] the deceased asked, "Shall I recover?" The surgeon said, "No." The patient grew better, but relapsed, and then repeated the question.

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[1] 1 C.C.R., 187.

[2] 9 Cox, C. C., 337.

[3] 67 J.P., 151.

[4] 2 Lewin, C. C, 147.

The surgeon then said, "I think you will not recover." The deceased said, "I think so too." It was held that a declaration made after this conversation was admissible.

In *R*, v. *Mitchell*[1] the deceased was told by the physician that there was little or no hope of her recovery, and upon being asked whether she understood her position, replied that she did. It was held that there was no proof of a hopeless expectation of immediate death which would make her declaration admissible.

PRESENCE IN COURT

In England medical and scientific witnesses, except in special circumstances, are allowed to be present in court and to hear the whole of the evidence in the case. In some instances this is absolutely necessary if the court requires medical opinions; for, unless the witnesses are fully acquainted with the facts, they can give no opinions, and they can become fully acquainted with the facts only by being present and by hearing the evidence in court. If excluded, the judge or counsel will be compelled to read to the witness notes of the evidence before an opinion can be given, and it may appear subsequently that some small point is omitted which, if known to the witness, might have affected his opinion materially. A miscarriage of justice may take place when medical witnesses are excluded, and it is usually where there is no real defence or a false defence that the right of excluding them is exercised. The rule in Scotland is different; there medical witnesses are rigorously excluded from court during the hearing of other medical evidence. It is, of course, easy to imagine circumstances in which it might be advisable that a medical witness to *facts* should not be in court during the evidence for the other side, but such circumstances are not common.

FEES IN COURT CASES

There is a very well-known statement that the labourer is worthy of his hire. This may, perhaps, cut both ways; but when consideration is given to the arduous and responsible duties of a medical man in the ordinary exercise of his profession—duties which frequently involve the question of life or death to a patient according to the promptness and skill with which such duties are performed—and in view also of the importance of the medical evidence in all cases where it is required, the fees allowed by law are considered by many practitioners to be inadequate.

The latest Home Office orders provide as follows :—

" 1. **Witnesses giving Professional Evidence.** There may be allowed to practising members of the legal and medical professions, for attending to give professional evidence, but not otherwise, allowances not exceeding the sums stated in the following scale :—

For attending to give evidence in the town or place where the witness resides or practises—

if the witness attends to give evidence in one case only, not more than one and a half guineas per diem ;

if the witness gives evidence on the same day in two or more separate and distinct cases, not more than three guineas ;

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[1] 17 Cox, C. C., 503.

For attending to give evidence elsewhere than in any town or place where the witness resides or practises, whether in one or more cases, not more than three gineas per diem.

" In this regulation ' town ' means municipal borough or urban district ; and ' place ' means within a radius of three miles from the court at which the witness attends to give evidence.

" No allowance may be given under this regulation to the solicitor for the prosecution, except that, if such solicitor gives professional evidence which, in the opinion of the proper officer of the court, was necessary and saved the attendance of another witness, a fee of 6*s*. 8*d*. may be allowed.

" 2. **Expert Witnesses and Interpreters.** There may be allowed (*a*) to expert witnesses such allowances for attending to give expert evidence as the court may consider reasonable, including, where necessary, an allowance for qualifying to give evidence, and (*b*) to persons employed as interpreters, such allowances as the court may consider reasonable."

" 7. **General Regulation.** No full day allowance under regulation 1 shall be paid unless the witness is necessarily detained away from his home, or place of business or employment, for at least four hours for the purpose of giving evidence.

" If the time during which the witness is necessarily detained away from his home, or place of business or employment, be less than four hours, he shall receive not more than one-half of the allowance which he would have received had he been detained for the full day.

" 8. **Travelling Allowances.** For attending court from a distance of over two miles there may be allowed :—

(1) To witnesses travelling by railway or other public conveyances the fare actually paid. Railway fares, except for special reasons allowed by the court, shall be third class ; and if return tickets are available, only return rates shall be allowed. In the case of police witnesses the reduced rates under the Cheap Trains Act, 1883, shall not be exceeded, except where the single fare is less than 1*s*. or for special reasons allowed by the court :

(2) Where no railway or other public conveyance is available, and one or more witnesses necessarily travel by a hired vehicle, the sum actually paid for the hire of such vehicle, not exceeding 1*s*. 6*d*. a mile each way, provided that where two or more witnesses attend from the same place, the total allowance shall not exceed 1*s*. 6*d*. a mile each way, unless the court is satisfied that it was reasonably necessary to hire more than one vehicle.

(3) To each witness travelling on foot or by a private conveyance where no railway or other public conveyance is available a sum not to exceed 3*d*. a mile each way.

For the conveyance of witnesses suffering from serious illness, or for the carriage of heavy exhibits, sums in excess of the above rates may be allowed if the court is satisfied that the expense incurred was reasonably necessary."

Hotel expenses of witnesses are in the discretion of the taxing master ; but there seems to be no allowance for the cost of employing a *locum tenens*. These rules are now the law ; and special cause has to be shown in any case why they should be departed from.

In the Coroner's Court. By the Coroners (Amendment) Act, 1926, the fees payable to a legally qualified medical practitioner who has made a *post-mortem* examination at the direction or request of a coroner, or who has attended an inquest in obedience to a coroner's summons, are (with the exception stated below) as follows :—

(*a*) For attending to give evidence at any inquest whereat no *post-mortem* examination has been made by the practitioner, one-and-a-half guineas for each day on which he is required to attend : and (*b*) For making a *post-mortem* examination of the body of the deceased and reporting the result thereof to the coroner without attending to give evidence at an inquest, two guineas[1] : and

(*c*) For making a *post-mortem* examination of the body of the deceased (including the making of a report, if any, of the result thereof to the coroner) and for attending to give evidence at an inquest on the body, three guineas for the first day and one-and-a-half guineas for each subsequent day on which the practitioner is required to attend :

Provided that no fee or remuneration shall be paid to a medical practitioner for the purpose of a *post-mortem* examination instituted without the previous direction or request of the coroner.

In cases, however, where a coroner, in exercise of the power conferred upon him by s. 22 of the Coroners (Amendment) Act, 1926, requests a specially qualified person to make a *post-mortem* examination or a special examination, the foregoing provisions prescribing the fees payable to medical witnesses shall not apply ; but the fees payable in respect of any such examination shall be such as may be prescribed by the schedule of fees, allowances, and disbursements made by a local authority under s. 25 of the Coroners Act, 1887, or by rules made by the Secretary of State under the Coroners (Amendment) Act, 1926.

Higher Civil Courts. In the High Court of Justice and in the Court of Appeal, 1*l*. 1*s*. a day if resident in the town where the case is tried, and 2*l*. 2*s*. to 3*l*. 3*s*. a day if resident at a distance from the place of trial, inclusive of all except travelling expenses. The travelling expenses of witnesses are allowed according to the sums reasonably and actually paid ; but in no case are they to exceed 1*s*. per mile one way.

The medical witness should remember that :—

(*a*) In criminal cases (including the coroner's court) when once he has accepted a *subpœna, he has no option whatsoever at any time subsequently* ; he must attend and give evidence under the above scale of fees.

(*b*) In civil cases, even after accepting a *subpœna, but before being sworn* (for attending to the *subpœna, vide supra*, " Subpœna ") and before he consents to give evidence, he should insist upon having in writing an agreement as to his fees, both as to amount and as to the person who is to be responsible for payment. After taking the oath, he is subject to the rules of the court, and must give his evidence regardless of the prospects of receiving a fee, adequate or inadequate. Inasmuch as fees are recoverable only from principals, unless there is a special agreement to the contrary, a medical witness should take care in all cases where his attendance is required in a civil court to give expert evidence, that there is a special agreement in writing binding the solicitor who requires the attendance to pay the fees himself. A solicitor who serves a *subpœna* is not liable for the fees. In a case in which an action was brought against a solicitor for the amount of the fees it was decided that, as a rule, a solicitor is merely the agent of another person ; and if he simply serves a man with a *subpœna*, he is not liable; for the witness's action for expenses is against the principal. This emphasizes the necessity for a special agreement.

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[1] The Departmental Committee on Coroners (1936) recommended an increase from two guineas to three guineas for the *post-mortem* examination as well as the provision of the travelling expenses of the pathologist to the mortuary and subsequently to the inquest.

(*c*) An *unregistered* medical practitioner, whatever his diplomas may be, is in exactly the same position as an unqualified "quack," so far as recovering fees by legal process is concerned; he may accept what is offered him, but can recover his fees only on an agreement *made beforehand* in the same way as any other person.

WIFE AS AGENT FOR HUSBAND

While a husband and wife are living together, it is a presumption of fact that the wife is agent for, and has the authority of, her husband to pledge his credit for necessaries supplied to their establishment which are suited to his station in life. A wife has implied authority to bind her husband for reasonable expenses for medicines and medical attendance incurred during illness; but this implied authority may be terminated if the husband gives sufficient notice that he will no longer be responsible for any debts which his wife may incur.

Travers v. *Sen*[1] was a case on the authority of a wife to pledge her husband's credit for fees for her accouchement. It was held that the wife had contracted only as an agent for her husband, and that an action could, in the circumstances, be brought only against him and not against the wife.

MIDWIVES ACT, 1936

The fees payable to medical practitioners who are called in by midwives in maternity cases are prescribed by Regulations made by the Minister of Health under the Midwives Act, 1936.[2]

Recovery of Fees. With certain exceptions (*e.g.*, Fellows of the Royal College of Physicians) medical men can sue for their fees according to a scale which varies with the social position of the patients visited, provided that the fees be fair and reasonable. In all professional dealings between medical men and their patients the customs of the profession will be considered as imported into the contract unless excluded expressly or by implication.

Fees under the Road Traffic Act, 1934, s. 16. Where medical or surgical treatment or examination is immediately required as a result of bodily injury (including fatal injury) to any person caused by, or arising out of, the use of a motor vehicle on a road, and the treatment or examination so required is effected by a registered medical practitioner, the person who was using the vehicle at the time of the event out of which the bodily injury arose is under an obligation to pay to the practitioner, or, where such treatment is effected by more than one practitioner, to the practitioner by whom it is first effected—a fee of twelve shillings and sixpence in respect of each person in whose case such treatment is effected by him; and a sum, in respect of any distance in excess of two miles which he must cover in order to proceed from the place whence he is summoned to the place where such treatment is carried out by him and to return to the first-mentioned place, equal to sixpence for every complete mile and any additional part of a mile of that distance.

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[1] 38 T.L.R., 202.

[2] 1940 S.R. & O., No. 602.

DENTISTRY BY MEDICAL PRACTITIONERS

By the Dentists Act, 1921, it is provided that, subject to certain exceptions, no person who is not registered under the Dentists Act, 1878, shall practise or hold himself out as practising, or as being prepared to practise, dentistry ; and that any person so doing shall, in respect of each offence, be liable upon summary conviction to a fine not exceeding 100*l*. The Act does not, however, apply, *inter alia*, to the practice of dentistry by a registered medical practitioner, nor to extractions of teeth without anæsthetics by a registered pharmaceutical chemist registered under the Pharmacy Act, 1852, or a registered chemist and druggist registered under the Pharmacy Act, 1868 (as amended by the Pharmacy Act, 1933).

CHAPTER II

MEDICO-LEGAL RESPONSIBILITY IN THE EXAMINATION OF THE PERSON, ALIVE AND DEAD

A. Examination of the Living

Throughout this work cases are referred to in which it is necessary for the ends of justice that a living person should be examined medically; it is important, therefore, that this subject should be considered generally apart from the particular circumstances which may render an examination advisable.

This is the more necessary in view of the profound ignorance of the subject which seems to obtain among medical men, whether private practitioners or medical officers.

A medical man acting in his private capacity, or a medical officer acting in his official capacity, may be called upon to examine :—

(i.) An adult male or female (capable of giving consent);

(ii.) A child under age;

(iii.) A person incapable for reasons other than that of age of giving a valid consent.

The person to be examined may be :—

(*a*) In the custody of the police, charged with an offence or crime;

(*b*) Not in custody, perhaps not even charged, but suspected by the police;

(*c*) Neither in custody, nor even suspected by the police, but suspected or charged by other persons, *e.g.*, employer;

(*d*) In a civil case, *e.g* divorce, nullity, chastity, etc.

(*e*) A private patient, in the ordinary course of practice or in insurance work, etc.

This last category is inserted for the sake of completeness, in order that every possible case may be included. It is worth while, however, even in this category, to point out to medical men that although the fact that a visit is paid to a practitioner implies consent to a certain amount of examination, it must not be concluded that such a visit entitles the medical man to compel an examination more intimate than the patient desires. If, for instance, the physician considers a vaginal examination is necessary in order to complete his diagnosis, and the patient refuses her consent, he must not insist upon such examination. He should explain the manner in which this refusal prevents him from helping her, and how she is wasting her money and his time by consulting him at all. Beyond such expostulation, all that is said below as to judical examinations holds good.

In all cases where an examination of the person is desirable, it should be made, because valuable evidence bearing on the case may be obtained from such examination.

The following general propositions may be made :—

(1) Such an examination may be made only with the consent of the person concerned ; if made without consent, it is technically an assault ; and may possibly be an aggravated or even an indecent assault.

(2) In ordinary circumstances it is beyond the powers of a policeman, coroner, lawyer, magistrate, judge, or even a bench of judges, to make a valid *order* for the medical examination of anybody's person.[1]

The following propositions in regard to " consent " are made on the authority of decided cases, and of the dicta of judges :—

(*a*) Consent must not be obtained by fraud, nor by any undue moral pressure or duress ; it must be given freely after a full explanation of the reasons for which it is desired, and of the consequences which may result from it. It must be constantly remembered that in this connection silence does not give consent, nor is compliance necessarily to be taken as consent.

(*b*) In any case in which there could possibly be any doubt, the consent should be given in writing ; and in all cases it should be given in the presence of disinterested witnesses, as otherwise there may be difficulty in proving it.

(*c*) Where the person is incapable, through age or through lack of understanding, of giving a valid consent, permission must be obtained from the parent or guardian.

(*d*) The medical man should ask himself the questions : " Have I strong grounds for believing that an examination is really necessary for clearing up points which are vital to the case ? " " Are my grounds such that I could make them convincing to a jury if I were charged with assault ? " In other words, he should have the support of his own conscience that he is acting honourably and justly.

Lastly, it must be remembered that refusal to submit to an examination is not necessarily an admission of guilt. For instance, a prisoner may be suffering from venereal disease, and be unwilling that this should be disclosed, and yet may be innocent of the crime with which he is charged. If the complainant also has venereal disease this coincidence is not conclusive either way. Again, an innocent woman is just as likely or even more likely to refuse consent, as one who is guilty.

Furthermore, a desire to be examined must not be regarded at once as a proof of innocence. Men who commit crimes like rape, unnatural offences, etc., are frequently well aware of the importance of an examination as *prima facie* evidence in their favour, should it be negative, and it is surprising how often a criminal assault has been committed without leaving any trace upon the accused.

When consent has been obtained, the examination should invariably be made in the presence of a third party : neglect of this precaution has ruined more than one medical man of good repute.

Police Surgeons, *i.e.*, medical officers acting in an official capacity, may be desired by police officers to examine persons in custody or suspected by the police ; and they are sometimes asked to aid in detective work in cases where one of several women may be guilty.

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[1] The right of search of the *clothing* of prisoners apparently stands on a different footing ; a nice point might arise if a person were suspected of concealing stolen property in any of the natural passages of the body : if a medical man were called to such a case he should obtain either consent from the person suspected or a guarantee in writing from the authorities at whose request he is acting.

The following is from the Police Orders issued to the Metropolitan Police entitled :—

Medical Examinations—Cases Involving[1]

Sexual Offences, etc. Medical examination should be made of prisoners charged with such offences as rape, and Station Officers must see that the examination is made where a prisoner consents. It is impracticable to give a complete list of the offences to which this order applies, but it includes unnatural offences, all felonies, and the misdemeanours under ss. 4, 5, and 11, Criminal Law Amendment Act, 1885, and all cases in which the examination seems likely to furnish evidence as to the prisoner's guilt or innocence.

Every prisoner to whom this order applies must be clearly told by the Station Officer, in the presence of the officer in charge of the case, that it is proposed to examine him, and that he has the right to object if he so desires. The examination must never be made under this order without the prisoner's *express* consent ; for, in the absence of consent, any examination would be an assault.

If a prisoner consents to the examination, it must be made by the Divisional Surgeon, or, in his absence, by some other doctor called by Police, but the prisoner should be told by the Station Officer, in the presence of the officer in charge of the case, that if he desires the attendance of a doctor on his behalf, an opportunity for such attendance *jointly with the Divisional Surgeon, or other doctor called by Police,* will be given.

Arrangements are to be made for the examination to take place as soon as practicable after the prisoner is in custody and removed to the Station, and before he is taken before a Magistrate.

Every prisoner who requests examination by a private doctor is to be given clearly to understand that he will be responsible for the fee of the doctor attending on his behalf ; and the private doctor, when called, is to be informed that his attendance is requested by the prisoner, who is solely responsible for his fee.

The officer in charge of the case will make an entry in his pocket-book, (*a*) of every proposal for a medical examination, and of the prisoner's consent or refusal, in his presence and (*b*) of the offer made to the prisoner to allow a doctor to attend on his behalf, and his acceptance or rejection of the offer. The entry will be initialled at the time by the Station Officer and will be available for the Court if necessary. The facts will also be recorded in the Occurrence Book by the Station Officer.

The Divisional Surgeon must make a separate entry in his private memorandum book and in the Surgeon's Report Book of the result of any examination, and he must be informed of the time and place where he will be required to give evidence before the Magistrate.

If, in addition to the Divisional Surgeon, or other doctor, called in the first instance by Police, the services of another doctor are obtained at the request of the Magistrate to make a further examination, the fee will be paid by Police.

These orders do not interfere with the customary police or other search of prisoners charged with felony, with a view to discovering evidence bearing on the charge, under another paragraph, nor do they interfere with the customary practice as to medical aid.

Other Offences. *Guiding Principles.* The following guiding principles must be very carefully borne in mind :—

(1) A medical examination will take place only if expressly requested by a prisoner (or, with his consent, by friends) or when Police deem it necessary in the light of the ensuing instructions.

(2) Examinations on behalf of Police will ordinarily be made by a Divisional Surgeon. If a Divisional Surgeon is not available and the circumstances so require, the services of the nearest suitable doctor should be obtained, and references in these instructions to a Divisional Surgeon should be read as covering a doctor whose services are so obtained.

(3) Whenever a request for examination by a private doctor is complied with, the Divisional Surgeon will be called on behalf of Police.

(4) Divisional Surgeons and private doctors will be summoned *immediately* the necessity for medical examination arises.

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[1] The Editors gladly acknowledge their indebtedness to the Commissioner of Police, New Scotland Yard, for this information.

(5) The examination by either doctor should take place as soon as possible after arrival at the Station.

(6) An examination by a private doctor will be conducted in the presence of the Divisional Surgeon, or, if he is not immediately available, in that of the Station Officer.

(7) A prisoner will be responsible for the fee of a private doctor attending at his request, and, if convicted, will be liable for the fee in respect of the *initial* examination by a Divisional Surgeon.

(8) A prisoner who appears to be drunk may be suffering from illness and/or may have sustained injury which is not apparent. In any case where the *slightest* doubt exists, the Divisional Surgeon is to be summoned immediately.

General Directions as to Examinations at a Prisoner's Request. In the case of a prisoner in custody for any offence other than those dealt with under sexual offences, in connection with which a personal medical examination may be material to the accused, if such examination is *expressly* requested by the prisoner or, with his consent, by friends, it will be made at the earliest moment practicable either by the Divisional Surgeon, or by any doctor attending on behalf of the accused. In the latter case the Divisional Surgeon will be called on behalf of Police.

A prisoner who requests examination by a private doctor is to be given clearly to understand that he will be responsible for his fee, and that, if guilty, he will also be liable for the fee in respect of the Divisional Surgeon's *initial* examination. He is to be informed at the time of making his request that the Magistrate will be asked to order payment by him of the Divisional Surgeon's fee if he is convicted. If he desires to pay the Divisional Surgeon at the time, he may do so, the particulars being included in the entry in the Occurrence Book.

In such cases when examination by a private doctor is requested, the Divisional Surgeon and the private doctor are to be summoned without delay, the latter being informed that his attendance is requested by the prisoner who is solely responsible for his fee. The examination by either doctor will take place as soon as possible after his arrival at the Station, and in no circumstances should an examination be delayed owing to the non-arrival of the other doctor. An examination by a private doctor will be conducted in the presence of the Divisional Surgeon (if in attendance at the time) or the Station Officer. If the *private doctor* completes his examination before the arrival of the *Divisional Surgeon*, he should be informed of the impending examination by the latter in order that he may, if he so desires, be present. If the Divisional Surgeon completes his examination before the arrival of the private doctor, he should be requested to wait a reasonable time for the examination by the private doctor. If, owing to delay in the attendance of the private doctor or other cause, the Divisional Surgeon has left the Station before the arrival of the private doctor, the Divisional Surgeon should be recalled or the services of another Divisional Surgeon secured, and meanwhile the prisoner should be examined by his own doctor in the presence of the Station Officer, and the doctor should be informed that the Surgeon has again been summoned and be invited to remain in order that he may, if he so desires, be present at the further examination by the Divisional Surgeon.

Each doctor will, on completion of his examination, be asked to certify his opinion in writing.

Any fee incurred in respect of a second or further attendance by a Divisional Surgeon in consequence of a prisoner's request for examination by a private doctor will be borne by the Police Fund.

The officer in charge of the Station will expressly enter in the Occurrence Book the request by an accused person for a medical examination, and the compliance with it, and report the facts.

Supplementary Directions as to Particular Cases. When a prisoner charged with drunkenness denies that he is drunk and asks to see a doctor, he is invariably to be told that the Divisional Surgeon will be sent for, but that he is entitled to call in addition any doctor whom he may desire to nominate.

When a drunken person found on licensed premises is arrested, or when a police officer is found drunk on licensed premises, and proceedings are likely to be taken against the licensed person, the Divisional Surgeon will be called in to examine the prisoner or officer.

Any request that a licensee's own doctor be allowed to examine a prisoner found drunk on licensed premises will be refused.

The services of the Divisional Surgeon will be obtained at once to certify as to the prisoner's condition before the charge is entered, *irrespective of whether the charge is, or is not, denied*, in *every* case in which a person is charged with :—

(*a*) driving, attempting to drive, or being in charge of a motor vehicle while being under the influence of drink or a drug to such an extent as to be incapable of having proper control of the vehicle ; or

(*b*) being drunk while in charge of a horse or a vehicle, other than a motor vehicle.

In the case of charges under (*a*) the attention of the doctor or doctors should be called to the actual terms of the charge and to the fact that they do not allege that the person is necessarily drunk.

In the event of a person charged with either of the offences specified in (*a*) or (*b*) being examined at his own request by more than one private doctor, an equal number of doctors, preferably Divisional Surgeons, is to be called on behalf of Police. In these circumstances a prisoner will be liable for the fee incurred for the initial examination by *each* doctor called on behalf of Police.

When a sailor, marine, soldier or airman is in custody of Police for drunkenness, etc., and he expresses a desire to be examined by a doctor and is willing to pay his fee, a doctor may be called to give an expression of opinion as to his condition, even if he is only detained for the arrival of an escort. If the doctor called is not the Divisional Surgeon, the latter must also be called on behalf of Police.

Special attention should be directed to the fact that free consent is essential. He who steps outside the four corners of this written document does so at his peril, whether he be a practitioner called in by the police or a police surgeon.

The following is a flagrant instance of overstepping the bounds of duty :—

A child was born in the street apparently from one of two women who were passing along ; the child was taken in by a passing Samaritan ; the two women went into a house in a street a short distance away. Next morning the police visited the house into which the women had gone, but the women had disappeared ; the police traced them to another house ; sent for the police surgeon, and, upon finding the women, requested the surgeon to examine the younger of them, using this expression to her, "*If you don't consent, I shall take you into custody.*" The police surgeon thereupon examined her and found her a *virgo intacta*.

It is difficult to say who was the more deserving of blame, the police or the police surgeon, for both were violating every principle of justice, mercy, and decency, there being nothing but circumstantial evidence (which turned out to be absolutely misleading) to connect the woman with what, at its worst, was a doubtful crime ; moreover, consent gained under a threat of arrest is not " free " consent.

In the case of a person in custody on a criminal charge there seems to be an absence of unanimity of opinion among the English judges as to the necessity for obtaining consent before examination ; medical practitioners should therefore adopt the rule of " safety first."

In a case of unnatural offence tried at the C. C. C., a divisional surgeon of police was severely censured by the judge for not cautioning the prisoner as to the result of the examination, and for thus taking advantage of the prisoner's ignorance.

A much-needed warning is necessary where a medical **practitioner is called in by a private person** to examine a maidservant or other woman of an age at which a valid consent is possible.

When a domestic servant is suspected of being pregnant, the mistress generally sends for her medical attendant to make an examination in order to confirm or to rebut the suspicion. A medical practitioner who is summoned for such a purpose should be careful to explain to the mistress that such examination can take place only with the free consent of the suspected servant, that compliance does not mean consent, and that the result of the examination cannot be divulged without the consent of the person examined. The servant should be told the reason for the examination, assured that it is in her interest to clear up the suspicion, and informed clearly that it is for her to decide whether she will be examined or not. The following case is a warning to all practitioners who are consulted in such cases.

A housemaid, *æt.* 28, was in the service of Captain and Mrs. B., who some time before the occurrence had been absent from home. They returned on the 23rd December, and on the 27th, in consequence of some information given by a charwoman to Mrs. B., the latter came to the conclusion that the maid was pregnant, and told her to pack up and leave before 12 o'clock, as she was "in the family way." This the maid denied. Mrs. B. replied, "The doctor will be here directly"; referring to the physician who, unknown to the maid, had been sent for previously. Mrs. B. told the maid to go to her room; the maid cried; Mrs. B. forbade her to speak. The maid went to her bedroom, and shortly afterwards the physician also came there. The maid cried, said that she had never had such treatment before, asked him what he was going to do to her, and said that she did not wish to be examined. There was some conflict of evidence between the maid and the physician whether she consented or not (which might have been avoided if the examination had taken place in the presence of a third person, as should always be the rule). The physician examined her, and found that there were no indications whatever of pregnancy; in spite of this, Mrs. B. dismissed her, and refused to give her a character. The maid brought an action against her master, mistress, and the physician. The case was tried at Manchester Assizes before Mr. Justice Denman; and, as the jury could not agree, they were discharged. It was retried at the following assizes before Mr. Justice Lindley, who withdrew from the jury the case against the master and mistress, as he considered that there was no evidence against them of the maid's non-assent upon which the jury could reasonably act, whereupon a verdict was found for the physician. But the case was not allowed to end there. The Vigilance Association assisted the maid in taking the case to the Court of Appeal, when the defendants were required to show cause why the verdict should not be set aside and a new trial ordered on the grounds that the learned judge ought not to have withdrawn the case from the jury, and that the verdict was against the weight of the evidence.

In the Court of Appeal, Brett, L.J., said:

> "I cannot conclude this judgment without expressing my abhorrence of the whole conduct with regard to this unhappy girl from beginning to end. I cannot conceive how right-minded people should, because they suppose—even if it had been true—that a young girl is in the family way, immediately take it into their heads that they are insulted. Why on earth should they have sent for the doctor? If they did not like to keep the girl, why not let her go away as quietly as possible? This idea of having servant girls examined by doctors is, to my mind, absolutely wrong, and it is conduct which everybody ought to scout."

Another common reason for the advisability of an examination of a woman is where **infanticide or even concealment of birth** is alleged to have occurred; for example, where the dead body of an infant has been found, and the police are endeavouring to find the mother. If she be known, it may be necessary, in order to connect her with the birth of the child, to determine whether she has been recently delivered. Medical evidence may show that the date of delivery does or does not correspond with the date of the birth and death of the child (*vide* Section dealing with the Signs of Delivery). It might occasionally be necessary to measure the pelvis of the woman to ascertain whether a rapid or protracted delivery might have occurred.

It has happened that medical men have assumed to themselves the right of enforcing an examination of a suspected woman, and, by threats or otherwise, have compelled her to undergo this. Such a course of conduct is improper ; and it is only when a woman willingly consents to be examined that a medical man is justified in making an examination. When a medical man takes this authority upon himself, and compels a suspected woman, unwillingly, or under duress, to submit to a physical examination, he is forcibly compelling her to produce positive proof of her guilt. The mischievous results of such officiousness on the part of a medical man are well illustrated by the following cases :—

A surgeon and an inspector of police insisted upon examining two women, a mother and daughter, in order to determine whether either of them had been lately delivered of a child. This was against their wish, and in the absence of the husband and father, who brought an action against them, and recovered damages. In another case the dead body of a child had been found near the plaintiff's house. The defendant, a surgeon, went with an inspector of police to see the plaintiff's wife ; and, having informed her that she was suspected of having had a child, told her that he had come to examine her by the authority of the law, and that she must submit. She refused at first, and proposed to send for a medical man whom she knew. In the end the defendant examined her, and found that there was no ground for the charge. The jury awarded 200*l*. damages for the assault.

The police can give no legal power to a medical man to make such an examination in a suspected case, and the ultimate consent of the woman, if extorted by threats or intimidations, will be no answer to a charge of indecent assault.

In the following case the question of medical responsibility in cases of alleged infanticide was placed in a very painful light.

The coroner held an inquest on the body of a child in a case of alleged infanticide. A suspicion arose that a young lady, the sister of a clergyman, had been recently delivered. Two medical gentlemen, armed with a written order from the coroner, went to the rectory where she was residing, and requested an interview with her for the purpose of ascertaining whether she had recently had a child. She refused to see them, and subsequently took her life.

The medical men, in endeavouring to justify themselves for the part which they took in the matter, relied upon the written order of a coroner. In fact no coroner has authority to order the performance of an illegal act ; and, if he should make such an order, it should not be obeyed. In the interests of the medical profession, and as a guide in future cases of this kind, the following legal opinion on the subject was obtained :—

"After diligent search on the subject of a coroner's authority, I entertain no doubt that an order for the physical examination of a woman, in a case of suspected infanticide and concealment of birth, is grossly illegal. Such a method of obtaining evidence is completely at variance with our principles of justice ; and I can find no authority for it anywhere.

"The practice of searching persons in custody is simply a police regulation for purposes of safety, to prevent suicide, and for the discovery of stolen property, and has no analogy to searching a woman's person in order to obtain evidence of concealment of birth.

"The coroner issuing such an order, and the medical man acting under it, would alike be liable to heavy damages in an action ; and every surgeon acting under the orders of the police, or any other authority, is bound to see that the order is not in excess of their jurisdiction.

" Whether any, and if so what, change in the law on the present subject is desirable, is a matter not now in debate ; but the question, whenever opened, will prove to be a very wide one."

Although no decision on this question may have been made by the judges, inasmuch as they denounce in the severest language the conduct of the police and of medical men in putting questions to and extracting incriminating answers from a woman charged with child-murder, they are not likely to spare a person who obtains from a woman by force or intimidation evidence of her criminality by a compulsory physical examination. An illegal order made by a coroner will not exonerate a medical man from responsibility for an assault

Again, there are the cases of **males charged with rape or indecent assault.**

In *Boulton* v. *Park*, a London police surgeon received a very stern rebuke from the judge for having examined one of the accused, while in custody, without having first obtained his consent. The learned judge told the witness that the prisoner would have been perfectly justified in knocking him down !—

The following case illustrates the difficulties with which medical men may be faced :

In *Spicer* v. *Hall*[1] it was alleged that Dr. Vincent Hall, knowing that Mr. Spicer was away in hospital, called at the house of Mrs. Spicer, and, after some conversation in reference to there being no children by her marriage, forcibly, and against her will, made an examination of her, which caused her much distress. Mrs. Spicer gave evidence in support of this allegation ; but she admitted that she had not told her husband until later although she alleged that she had told certain women in the district. She could not fix the date of the alleged assault, but gave it approximately as being about thirteen months before the trial.

Dr. Vincent Hall said that he had called at a certain date upon Mrs. Spicer to inquire after her husband, whom he had sent into hospital, taking much interest in the case. Mrs. Spicer had some conversation with him about her childless condition, and asked if it were possible for her to have children. He told her that he could not tell without making an examination, which she then asked him to make. He demurred, stating that he could not do this without someone else being present ; to which she objected strongly. After some further conversation, he consented to make the usual examination at her desire.

Dr. Hall was cross-examined ; and other witnesses were about to be tendered by the defence, when the jury stopped the case, and a verdict was given for Dr. Hall.

The danger of making **examinations of girls without the presence of a witness** is illustrated by a case tried at Margate Quarter Sessions in 1903, when a sentence of six months' hard labour was awarded for assault ; there was no corroboration of the testimony of the girl, who alleged that the examination was made without consent. By the Children and Young Persons Act, 1933, s. 38, the evidence of children of tender years must be corroborated by some other material evidence.

Special conditions are laid down for the **examination of the person under the Workmen's Compensation Act** (*vide* " Insurance ") ; but neither these cases nor any civil action for damages can give rise to any trouble to a practitioner who acts in accordance with the suggestions given above.

B. Examination of the Dead Body

For the examination of a dead body, or of human remains, no further authority than the written order of a coroner (or the Sheriff in Scotland) is required, or the consent, in non-judicial cases, of the nearest relative or guardian.

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[1] *B.M.J.*, Dec. 14, 1901, p. 1787.

As to the "possession" of a dead body, and performing a *post-mortem* examination without consent, the law recognises no property in a dead body except in so far as it belongs to the deceased's personal representatives for the purpose of disposing of it according to law. It is a misdemeanour (*a*) to prevent the burial of a dead body; and (*b*) to neglect to bury a dead body which one is legally bound to bury (*e.g.*, that of a man's wife or child), provided that one is not legally bound to incur a debt for such a purpose. If a *post-mortem* examination be held without consent, no offence at law is, *ipso facto*, committed; it is only a moral offence against the relatives, which should, of course, be avoided. No assault can be committed upon a dead body. Similarly, removal and preservation of organs is no offence. One or two actions have been brought by living persons claiming portions of their anatomy, or pathological products, such as stones, which have been removed; judgment has always been entered for the claimant.

The safe rule is that a *post-mortem* examination should be made whenever the cause of death cannot be determined beyond reasonable doubt from the general and medical evidence, but if a medical man cannot give a certificate of the cause of death, the body will pass into the control of the coroner. A medical man cannot legally claim a fee for what he has done without official authority. Can he be compelled to state the result of his examination? The result is open to argument; but, on the whole, it would seem that he could not, on the ground of professional secrecy, decline to divulge the knowledge which he had acquired at the *post-mortem* examination.

In cases of this sort, the line of conduct which a medical man should pursue is as follows :—

1. If it is obvious that the **cause of death was natural** and the medical man desires a *post mortem* solely for his own professional information, he must obtain the permission of a responsible relative or guardian before acting; if another relative should object, the medical man would act more wisely by at once desisting, but if he still persists he is acting illegally only when he forces access to the body against the authority of the head of the house wherein the body lies; the *post-mortem* examination itself is not illegal in these circumstances.[1]

2. If there be any doubt that the **cause of death was natural,** and the medical man cannot clear up the point without an autopsy, the following alternative courses are open to him :—

He may explain fully to a responsible person his reasons for desiring an autopsy, with the result that he may obtain permission to perform it. He is then entitled to perform it, because he is at that stage uncertain whether an inquest will be necessary; but if he has made an autopsy under these conditions he must not, when signing the certificate, suppress any facts which he has acquired; and, if he finds evidence of unnatural death, he is bound to report the matter to the coroner. The following case in point occurred some years ago :—

A man about 40 consulted his physician on account of a cough. Phthisis was diagnosed, and treatment prescribed: he died suddenly a few days later: the physician explained to the friends that, if an autopsy were permitted, he might be able to give a certificate, otherwise an inquest must be held : consent being given, the autopsy was made, and a tiny ulcer discovered in the stomach from which fatal hæmorrhage had proceeded : an ordinary death certificate was given at once.

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[1] *Lancet*, 1909, 1, p. 1786.

If permission to perform a *post-mortem* examination is refused he must not give a certificate but should report the matter to the coroner, and should not touch the body until he has obtained a written order from that authority or from his deputy.

3. If the **cause of death be unknown,** he does nothing illegal if he performs an autopsy with permission, and, if he finds that the cause of death was natural, he can fill up the certificate to that effect without further delay.

If, however, in these circumstances he is refused permission, he is bound to refuse a certificate, and to report the matter to the coroner.

4. When once circumstances have arisen, whether before or after death, which necessitate a report to the coroner, a medical man must on no account touch the body for the purpose of an autopsy without the *written* authority of the coroner ; to do so is to render himself liable to be prosecuted.

The following case,[1] shows how an aggrieved person endeavoured to make a *post-mortem* illegal :—

A surgeon practising at Newnham was summoned to answer certain charges under the Anatomy Act of 1832. According to a report published in the *Gloucester Journal* it was alleged : 1. That he, upon July 25th, 1904, being a person lawfully qualified to practise medicine, unlawfully did practise anatomy without having obtained a licence in pursuance of 2 & 3 Will. IV. c. 75, empowering him to do so. 2. That on the same date, being qualified to practise medicine, he unlawfully did examine anatomically the body of John Price, without the permission or direction of the surviving wife. 3. That he did unlawfully carry on anatomy at a place to wit, the house of Emily Price, there situate, without having given at least one week's notice thereof before the first receipt or possession of the body for such purpose to his Majesty's Secretary of State for the Home Department.

The facts of the case appear to be shortly these : John Price died of heart disease on July 23rd Prior to his death he was being attended by a Dr. Harris or his assistant, but some years ago he had been attended by Dr. Carleton. On July 23rd Mr. M. F. Carter, coroner for the Forest Division of Gloucester, received a police report concerning the death of John Price. On July 24th Mr. J. W. Guise, who was acting as the coroner's deputy, received a communication from Dr.Carleton in reply to which he sent the following letter : " Dear Carleton, I did not know I was to hold an inquest to-morrow on poor Price. I have had no instruction myself from Mr. Carter to this effect. If, however, he tells you I am to, there is no doubt I shall do so. As to the necropsy, if you cannot arrive at the cause of death without one, please make it. It is my practice to leave these matters to the discretion of the doctor. If I am to hold an inquest I shall probably do so between five and six o'clock to-morrow." On July 25th Dr. Carleton called at the house of the deceased ; saw the body ; and made a necropsy. There was a dispute as to whether upon this occasion Walter Price, a son of the deceased, did not ask Dr. Carleton whether he had any authority to make the necropsy. Dr. Carleton, in the course of his evidence, said that he acted upon the written authority given by Mr. Guise, and that in his practice, which extended over twenty-six years, he had never held a necropsy without an order. He had not told the relatives of his intention for fear it would distress them. He had merely wished to clear up a mystery which existed in connection with the death. Dr. Harris made out a certificate of death from heart disease at 11.30 a.m. on Monday, July 25th.

At the conclusion of the evidence the magistrates retired, and upon returning said they considered that the summons must be dismissed. They did not think upon the evidence that a jury would convict. Dr. Carleton acted upon the best authority he could get, and the authority was the letter written by Mr. Guise.

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[1] *B.M.J.*, 2 : 624, 1904.

It is obvious that the Act was never meant to be applied to this offence, and it is doubtful whether a jury would ever convict.

The *B.M.J.*, *ibid.*, p. 611, comments on the case thus :—

" The law with respect to the body of a deceased human being is a little curious ; it is quite clearly the law of this country that a human corpse is a thing which does not and cannot belong to anyone ; this being the case, it follows that a man cannot, by will or otherwise, dispose of his dead body ; and even though he is at liberty to direct that his body after death be treated in a certain fashion, yet the fulfilment of those directions cannot be enforced upon the executors of the deceased's estate nor upon his nearest known relatives. At the same time, the legal personal representatives of a dead person have a right to the possession of that person's body and to its custody until it is buried or disposed of in some other lawful manner, such as burning, and in two well-known cases the dead person's representatives recovered possession of his body from creditors who attempted to detain it as security for the settlement of certain claims against the estate of the deceased. There have been not a few curious actions at law with regard to human corpses, and the fact that there could be no property in a corpse made it exceedingly difficult to put a stop to the practice of body-snatching. Since there was no property in a corpse it could not be stolen, and, provided that sacrilege was avoided, and the corpse alone removed, the act of removal was merely a misdemeanour. Prior to the Anatomy Act of 1832 the College of Surgeons and Physicians in England were entitled to receive annually for the purposes of dissection a certain number of the bodies of executed felons, and the bodies of all murderers executed in London and Middlesex." These privileges, however, have been abrogated by the Anatomy Act, 1832, which regulates the law relating to dead bodies. A human corpse cannot now be examined for any purpose, or even removed for examination, except upon certain stringent conditions ; while, once buried, it cannot be touched at all except upon the order of the Home Secretary in England or of the Sheriff in Scotland.

A *post-mortem* examination may be ordered by the Coroner without regard to any wish to the contrary expressed by the deceased or by his personal representatives. Apart from this statutory power of the Coroner to order a *post-mortem* examination, any medical man is legally entitled to examine a dead body if he obtains the permission of the personal representatives of the deceased or other persons having lawful possession of the body, unless the deceased shall have expressed a desire that the body should not undergo examination, or unless the surviving husband, or wife, or other person having possession of the body shall require the body to be interred without such examination. Such persons should be apprised of the intended examination, and be given a reasonable time for objecting thereto. The near relatives have a right to object even if the deceased during his life directed that his body should be examined after his death. Due observance of the statute is secured by penal provisions which make any failure to observe its provisions a misdemeanour, punishable by fine or imprisonment. No difference is made between the position of a private practitioner and that of a medical officer of a hospital or other like institution.

DISPOSITION OF DEAD BODY

Upon the death of a person the survivors are under a legal duty to bury or otherwise to dispose of the body. The ordinary method is by burial, but other methods, including cremation, are permissible (see Cremation Act, 1902, and Regulations made thereunder, 1930; also Births and Deaths Registration Act, 1926). Burial in private ground is permissible, unless the use of the ground for that purpose amounts to a nuisance or involves a breach of a statutory prohibition against burial in the particular locality.

The time within which a dead body must be buried, embalmed, or cremated may be regulated by the Minister of Health under the Public Health Act, 1936.

A justice of the peace may, on a medical certificate that the retention of a dead body in any building would endanger the health of persons concerned, order the body to be removed by and at the cost of the local authority from any building to a mortuary, and buried within a limited time or immediately; if the relatives or friends of the deceased do not bury the body or cause it to be removed within the time so limited, the local authority must bury the body at the public expense.[1]

BIRTHS AND DEATHS REGISTRATION ACT, 1926

The object of this Act is to render more complete and effective the safeguards afforded by the law of registration in relation to the disposal of the dead, with a view to eliminating, as far as possible, any element of risk or opportunity for the concealment of crime. The Act amends in several important respects the law as to the certification of deaths and the disposal (by burial or cremation) of dead bodies. It prohibits the disposal of a dead body except under a registrar's certificate or a coroner's order. It requires ratification of such disposal to be made to the registrar, and prohibits the removal of a dead body out of England until the expiration of a notice to the coroner.

Still-births are required to be registered as a measure of additional safeguard for the protection of infant life. A still-birth is defined as a child which has issued forth from its mother after the twenty-eighth week of pregnancy, and which did not at any time after being completely expelled from its mother breathe or show any other signs of life. Since the Act came into operation no still-born child may be buried without a certificate. The Act places upon the medical practitioner concerned the twofold duty of delivering to the registrar a certificate of cause of death and of giving a written notice (in the prescribed form) of the signing of such certificate to some person required by the Births and Deaths Registration Acts, 1836 to 1901, to give information concerning the death. Further rules relating to the registration of still-births are contained in the Regulations issued in 1927, 1929 and 1930.

HOW TO MAKE AN AUTOPSY FOR MEDICO-LEGAL PURPOSES

In almost every section of this work there is an expressed or implied necessity for a *post-mortem* examination of the body; it seems desirable,

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[1] Public Health Act, 1936, s. 162.

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therefore, to give, once for all, some details of the procedure for such inspection in general, with observations on some special matters of investigation as they may be required.

In the first place, as a general rule, **it is never too late to make an autopsy.** No matter how far decomposition may have advanced, there is always a possibility of finding some material evidence necessary for the ends of justice. Bones, teeth, and hair are practically indestructible by decomposition, and other organs at times decay very slowly, and any of these may be very useful for purposes of identification if for no other reason; whereas the discovery of foreign bodies, such as fragments of weapons, bullets, or other objects, may afford a complete elucidation of a mystery.

The external appearances of putrefaction are often far in advance of the internal changes, so that they offer little indication for estimating what may be found by a complete inspection; certain poisons, such as arsenic, may exercise a certain local preservative effect. For these reasons the practitioner should never refuse to make a *post-mortem* examination on the ground that putrefaction is too far advanced.

The reasons why the body is examined may occasion a slight difference in procedure, but they should never afford an excuse for not examining it as thoroughly and completely as circumstances will allow. Inasmuch as it is impossible to foresee in what unexpected directions questions in court may lead, the second broad rule is: **Never be satisfied with less than a complete examination** of the three great cavities, abdomen, chest, and head, and all the organs contained in them, since it may be affirmed that a natural cause of death might have existed in that organ or cavity which the medical witness had neglected to examine.

If a mortuary is available an autopsy should never be performed in a dwelling-house, but, if it must be performed in the latter, the examiner should see that there is ample natural light for his purpose. It is a wise precaution never to attempt a *post-mortem* examination in artificial light unless it is absolutely essential.

As a last general rule: **Write down notes on the spot** of everything which is found: the fact that the paper gets soiled will not destroy the value of what is written, but rather enhance it; for it is so far evidence of the truth of what is written, *viz.*, it was written while facts were still fresh in the mind.

Instruments required. These are, or should be, provided by the authorities of the mortuary, but, as a precaution, the following should be included in a bag taken for the purpose: At least two good knives and a stout saw, a pair of scissors and bone forceps, together with needle and twine for sewing up the body. In addition it is well to have a tape measure, and an extra pair of scissors with very fine points for cutting along smaller tubes of any sort, also a pair of forceps; it is also a wise precaution to take two or three clean wide-mouthed bottles of capacity about a pint, to contain portions of viscera or their contents, vomit, etc., smaller bottles or tubes for taking samples of hair, blood and urine, and a few microscopic slides. Scales for weighing organs should be at hand if possible. If the case is one of suspected poisoning, sufficient chemically clean jars to take the whole of the viscera should be arranged for. A measuring cylinder and metal catheter may be found useful, and it is as well to take a pot of iodine, rubber gloves and clean overalls in case these essentials have been forgotten by the authorities.

A camera is very useful, and might almost be included in the list of necessaries, especially when the body is that of an unknown person, or when there are special circumstances connected with the external appearances. The police authorities, however, generally concern themselves with such matters as taking photographs and finger-prints.

Identification. The body should be identified in the presence of the doctor who should make a note of the names and addresses of the persons who identify it.

In every case it is essential to take notes on the points of identification enumerated on p. 83 *et seq.*, not omitting the more obvious, such as sex, age, height, probable weight, colour of hair, etc. : Any peculiarity in stains or dirt, either on the clothes or the person, may be of the utmost importance for reasons other than mere identification ; it is, in fact, impossible to be too precise in writing down all these external details.

The extent and the position of hypostases, the condition and extent of *rigor mortis*, and the state of the body with regard to putrefaction should be noted. These points, together with the observation as to the temperature of the body taken per rectum, may be of great help in fixing the time of death. The condition of the natural orifices—eyes, nose, mouth, ears, meatus of the urethra, vagina and anus—should be observed, and the presence of any deformity or change from the normal noted.

The next point is to make equally careful notes of the **external inspection** of the whole body for signs of violence, even of the most apparently trivial nature. In order that nothing may be omitted, it is well to have a fixed order of observation—head and neck, trunk, arms, legs.

This external examination may well be noted in two divisions : first, those marks which are probably not fatal in themselves, but which may throw great light on those that were fatal. The most important are :

Marks of powder grains or burns of powder, etc., in gunshot wounds.
Abrasions suggestive of violence.
Small cuts on the hands, etc.
Marks of finger-nails.
Marks about the mouth (poisons or suffocation).
Marks suggestive of the use of a hypodermic syringe.
Burns, however trivial.
Bruises.

All these require explanation of their presence, and they must be carefully considered in order to decide whether they suggest that a struggle has taken place. Remember that it may be as important to note their absence as their presence.

The second division includes the more serious matters, such as —
Fractured and dislocated limbs.
Cut throat and deeper cuts severing important structures.
Extensive burns.
Stabs or punctured wounds.
Gunshot wounds.

The practitioner will be expected to know *all* about them—when, how, by what means inflicted, etc., etc. It is impossible to enumerate everything that may be found, but the above remarks indicate the importance of noting everything.

Care must be taken that putrefaction of a wound is not mistaken for *ante-mortem* gangrene. The point is not always easy to ascertain, but it may be mentioned that pus and signs of inflammation *around* the wound are never caused by mere putrefactive changes. Further investigation of deep wounds may be left till the body is opened.

The next point is the interior inspection of the body, or the *post-mortem* as it is understood in ordinary cases of disease.

It is well to examine the cranial cavity before the abdomen or thorax is opened. A better chance is thus obtained of observing the condition of the intra-cranial venous channels as regards their fulness before they have had any opportunity of emptying themselves through a cut superior vena cava or jugular vein. The point is of no great importance, but some authorities think it may have a bearing on the question of whether death was actually due to some form of asphyxia or not (*vide* " Asphyxia ").

To open the head, the scalp is incised from ear to ear over the vertex, and reflected backwards and forwards from the incision. Any bruising of the deeper tissues of the scalp or damage to the bone will be noted. The skull cap is removed by sawing round the skull immediately above the level of the ears through the whole thickness of the bone ; a chisel should not be used, for it may cause a new fracture or the extension of an existing fracture.

The condition of the dura is observed, after which it is cut away and the brain exposed.

After examining *in situ* the brain is removed by placing the fingers under the frontal lobes, lifting with gentle traction, and cutting the cerebral nerves at the base. The knife is passed around the attachment of the tentorium cerebelli, and after it is free the cord is cut as far below the medulla as possible and the brain removed.

The surface and base are examined for hæmorrhage, injury or disease, and the condition of the cerebral vessels, especially the circle of Willis, observed for the presence of arterio-sclerosis and minute aneurisms.

The brain is then incised to ascertain the condition of the deeper cortex, the basal ganglia and the ventricles. It is immaterial what method is adopted, but incisions should be so arranged that they never completely separate the section, in order that the whole brain may be reconstructed if desired. The pons, medulla and cerebellum must also be sectioned. For complete examination of the brain it is desirable to fix it in 5 per cent. formalin, or other hardening agent, for a considerable time.

The membranes are stripped from the base and the bones examined for signs of fracture. Usually the site of a fracture will be indicated by hæmorrhage, but this is not always to be observed, and though the membranes are very difficult to remove, on no account should this precaution be neglected.

The presence and position of any hæmorrhage, injury or disease should be accurately noted, and in fractures the condition and thickness of the bones should be observed.

It is advisable to open up the middle ear and to investigate the condition of the frontal sinuses and antrum in all cases in which there has been suspected infection.

The spinal cord must be exposed in local injuries and in any death from convulsions.

It is not advisable to probe any deeply penetrating wound in the brain. It should be traced by coarse sections, in such a manner that the brain can be refolded, *i.e.*, the pieces are not actually severed from the bulk, but left attached by the meninges.

Having finished the examination of the brain, proceed to open the body in the usual way by a longitudinal incision from chin to pubes, with this special precaution, *viz.*, that when dealing with a case of cut, throat or wounds over any of the cavities of the body the incision should not interfere with the wound to be investigated, *i.e.*, this wound should not become part of the incision. After this, care must still be taken that in reflecting the tissues from the chest or turning back the abdominal parietes the anatomical relations of skin, subcutaneous tissues, and viscera are disturbed as little as possible, for it is by preserving this relationship that one is able to trace the direction of a wound, which is very often the most important element about it.

A warning has already been given against using a probe to track wounds in the brain: the same warning may be repeated here, but we are now dealing with tougher material than brain-matter, and therefore a soft catheter may be used. No more force than necessary must be exerted, for it may be asserted that the instrument, and not the original weapon, perforated the tissue. Dissection may then be carried on around the instrument, avoiding any interference with the external appearances. On no consideration should the weapon suspected to have been the causal agent be inserted into a wound to ascertain if it fits it.

The preservation of the external form will allow of a comparison being made at any future time between the edges of a wound and a weapon found on a suspected person. In the dissection every muscle, vessel, nerve, or organ involved in the injury should be traced and described. This will enable a witness to answer many collateral questions that may unexpectedly arise during the inquiry.

It is advisable to remove the skin with the external wound and preserve it in formalin solution for future reference.

Now remove the sternum and ribs, preferably with bone forceps, for if a saw be used it is apt to produce lacerated wounds of the viscera, and thus cause confusion between those produced by the violence before death and those produced by the saw; the differences are, in general, easy to detect, but that is no reason why matters should be needlessly complicated. The condition of the thoracic and abdominal viscera should be ascertained before anything is disturbed and any blood or other fluid or damage to any organ noted. If this precaution is not observed, the examiner is frequently in doubt as to whether any blood or damage to organs found later is a result of the dissection or whether it had previously existed.

After careful dissection and examination of the superficial and deep tissues of the neck, the knife is passed around the inner side of the lower jaw to separate the attachments of the tongue, which is pulled down into the opening, and by a few strokes of the knife it is reflected, together with the hyoid bone, pharynx, larynx, trachea and œsophagus from the posterior wall. This dissection gives a perfect view of the fauces and larynx, enabling any pathological condition to be readily recognised. The hyoid bone is examined for fractures, noting at the same time whether the two cornua are ossified or not, and with regard to this structure the examiner must not be deceived by the natural joints between the body and the greater horns.

The tongue should be examined for teeth marks and lacerations and sliced into sections to ascertain whether there are any bruises in the deeper tissues.

The œsophagus, larynx and trachea are cut into and examined.

As a rule it is better to remove the whole of the thoracic organs together with the tongue, larynx and trachea, but before this is done a ligature should be placed around the lower end of the œsophagus to prevent the escape of stomach contents.

The lungs are then examined, and the incision already made in the trachea is continued into the bronchi in order to detect foreign substances, froth, etc.

The external aspect of the heart is examined, after which the left ventricle is transfixed at its base and the incision carried to the apex. The condition of the muscle and endocardium is observed, and after the aortic valve has been investigated from above the incision is carried up by means of scissors into the aorta, avoiding the cusps of the valve. The internal aspect of the aortic valve, the openings of the coronary arteries and surface of the aorta are minutely examined, and by means of a fine pair of probe-pointed scissors the coronary arteries are opened up and examined for signs of arterio-sclerosis and partial or complete occlusion. The left auricle is then opened and the state of the mitral valve observed. The right side of the heart is similarly treated.

In cases of suspected air embolism, it is advisable to commence with a small incision into the right auricle to ascertain whether the blood is frothy, and in suspected pulmonary apoplexy the right ventricle and pulmonary artery should first be examined.

Having finished the examination of the chest and its organs, each organ of the abdomen should be examined in turn for the presence of disease or injury. It is advisable to open the whole length of the allmentary canal in view of the frequency of disease, which can be ascertained only by complete examination. In cases of suspected poisoning the procedure is somewhat different. (See Vol. II.)

The uterus, with its connections, and the vagina must be examined for signs of injury, abortion, child-birth, etc.

The bladder is examined after removal of its contents.

Some urine should be taken for examination for sugar, albumen, blood, pus, alcohol, etc., the presence of which may throw considerable light on an otherwise obscure case.

It is well also to take a good sample of blood from the chambers of the heart for examination when necessary for alcohol, volatile poisons, carbon monoxide, etc.

The fact that several days have elapsed since death will not prevent the discovery of food in the stomach, provided it had been taken within one or two hours before death, since the digestion of food does not appear to go on to any considerable extent after death. We have thus discovered food in the stomach twelve months after interment. The kind of food present and the state of its digestion has proved of importance in numbers of criminal trials (*vide* " How Long Dead ").

In examining the abdominal organs it is worth while to draw special attention to the fact that colour changes are very frequently found in those which lie close to the liver (kidney, stomach, duodenum, etc.), owing to the fact that the colouring matter of bile easily permeates the tissues. These colour changes must not be mistaken for signs of inflammation, or of putrefaction. If inflammation be present either pus or lymph will be found, the latter leading to sticky adhesions, or at least to a loss of lustre of the peritoneum ; the distinction is very easy if attention be drawn to the possibilities, but discoloration by bile is so striking that it may easily lead an inexperienced or careless inspector into a mistake.

Post-mortem Digestion of Stomach *v.* **Disease.** *Post-mortem* digestion of the stomach is a very common phenomenon ; in fact, nearly universal in some degree, but perforation from such digestion is comparatively rare. Dr. F. J. Smith observed it only about a dozen times in several thousand *post-mortem* examinations ; he noticed it almost entirely in young subjects. The exact cause why the stomach is sometimes perforated by autodigestion and sometimes not is not at all clear. *A priori* one would expect autodigestion in those cases where the stomach was healthy and actively digesting when death took place, but experience in the *post-mortem* room has shown that such is by no means invariably the case, for perforation has been seen in most unaccountable cases of lingering disease, and it has not been observed in many cases of accidental sudden death. Whatever the precise cause, the following differences hold in the appearances produced by digestion and by ulcer or inflammation :—

In Ulcer or Inflammation.	*In Digestion.*
(*a*) The edges are rather abrupt, and the margins invariably slightly thickened, or at least not thinned.	(*a*) The edges are not abrupt, and the margins are invariably thinned, thinner than the rest of the healthy stomach.
(*b*) The mucous membrane can be peeled off the stomach up to or from the edges of the solution of continuity.	(*b*) The mucous membrane cannot be so peeled ; it is soft and pulpy.
(*c*) The muscle in the edge of the ulcer or below the inflamed part is less affected than the mucous membrane.	(*c*) The muscle in perforation is as much digested as the mucous membrane, and equally soft and slimy.
(*d*) Adhesions may be present between the stomach and other viscera, or pus and other evidence of inflammation in peritoneum may be observed.	(*d*) There is no trace of adhesions nor of inflammatory signs or results.

When all the organs have been carefully examined and notes made on them, it must be remembered that these notes only form the material for a report ; the report itself must be carefully drawn up in order—first facts, then inferences if required (*vide* p. 8).

Post-mortem Infections. If the operator should prick his finger or otherwise wound himself during the performance of an autopsy, he should at once take steps to prevent infection. He must stop the autopsy immediately, remove his gloves, and hold the hand or injured part in warm (not hot) water for several minutes. Bleeding must be encouraged to wash out the wound, and if this does not take place freely by placing the hand in warm water the arm should be swung to produce a congestion and the tissues squeezed. After allowing free bleeding and washing for five minutes tincture of iodine may be applied and the finger bandaged. The member must be carefully watched for the next day or two in order to take prompt steps if infection should supervene. If the above precautions are attended to, no infection is likely to arise. If local or systemic evidence of infection does develop, appropriate local measures and adequate chemi-therapy should be instituted immediately, under directions from a surgeon.

CHAPTER III

FUNCTIONS OF THE GENERAL MEDICAL COUNCIL

The General Council of Medical Education and Registration of the United Kingdom—usually known as the General Medical Council—was constituted by the *Medical Act* of 1858. It is charged with the registration of Medical Practitioners, the publication of the *British Pharmacopœia*, the exercise of certain disciplinary powers over registered medical practitioners, and is concerned with the standard of medical education.

The Council consists of 42 members, of whom five are nominated by His Majesty with the advice of his Privy Council ; 27 are chosen by those Universities which have Medical Schools, and other Licensing Bodies ; seven are elected as direct representatives by the medical practitioners and three are appointed by the Privy Council as additional members under the Dentists Act.

Its disciplinary functions are those which are of interest from a medico-legal aspect. Section 29 of the *Medical Act*, 1858, states as follows :

> " If any registered medical practitioner shall be convicted in England or Ireland of any felony or misdemeanour, or in Scotland of any crime or offence, or shall, after due inquiry, be judged by the General Council to have been guilty of infamous conduct in any professional respect the General Council may, if they see fit, direct the Registrar to erase the name of such medical practitioner from the register."

The definition of infamous conduct in a professional respect was laid down by Lord Justice Lopez in Alison v. General Medical Council (63 L.Q.B. 534) as follows : " If it is shown that a medical man in the pursuit of his profession has done something with respect to it which would be regarded as disgraceful or dishonourable by his professional brethren of good repute and competency, then it is open to the Council to show that he has been guilty of infamous conduct in a professional sense." Every case in which a registered practitioner is convicted is reported to the Council and the Penal Cases Committee of the Council decide whether the conviction is of a nature serious enough to require the attendance of the practitioner before the Council. In cases of alleged infamous conduct in which there has been no conviction a complaint is usually laid before the Council by the aggrieved party supported by statutory declarations on which the Council may or may not open an inquiry. At any such inquiry the practitioner may be legally represented and the same is true when the Council is investigating a case of conviction. The Council has never attempted to define infamous conduct in any detail but from a succession of cases which have been heard and decided by the Council, certain offences are regarded as falling within the meaning of the term.

The Council have issued a Warning Notice, the main points of which follow.

1. **Certificates, Notifications, Reports, etc.** Registered medical practitioners are in certain cases bound by law to give, or may from time to time be requested to give, certificates, notifications, reports, and other documents of a kindred nature, signed by them in their professional capacity, for subsequent use either in courts of justice or for administrative purposes.

Any registered practitioner who shall be shown to have signed or given under his name and authority any certificate, notification, report, or document of a kindred nature, which is untrue, misleading, or improper, is liable to have his name erased from the Medical Register.

2. **Unqualified Assistants and Covering.** The employment by any registered medical practitioner in connection with his professional practice of an assistant who is not duly qualified or registered, and the permitting of such unqualified person to attend, treat, or perform operations upon patients in respect of matters requiring professional discretion or skill, is in the opinion of the Council in its nature fraudulent and dangerous to the public health ; and any registered medical practitioner who shall be shown to have so employed an unqualified assistant is liable to have his name erased from the Medical Register.

Any registered medical practitioner who by his presence, countenance, advice, assistance, or co-operation, knowingly enables an unqualified or unregistered person, whether described as an assistant or otherwise to attend, treat, or perform any operation upon a patient in respect of any matter requiring professional discretion or skill, to issue or procure the issue of any certificate, notification, report, or other document of a kindred nature (as more particularly specified in Division I hereof), or otherwise to engage in professional practice as if the said person were duly qualified and registered, is liable on proof of the facts to have his name erased from the Medical Register.

The foregoing do not apply so as to restrict the proper training and instruction of *bona fide* students, or the legitimate employment of dressers, midwives, dispensers, surgery attendants, and skilled mechanical or technical assistants, under the immediate personal supervision of a registered medical practitioner.

3. **Sale of Poisons.** The employment, for his own profit and under cover of his own qualifications, by any registered medical practitioner who keeps a medical hall, open shop, or other place in which scheduled poisons or preparations containing scheduled poisons are sold to the public, of assistants who are left in charge but are not legally qualified to sell scheduled poisons to the public, is in the opinion of the Council a practice professionally discreditable and fraught with danger to the public, and any registered medical practitioner who is proved to have so offended will be liable to have his name erased from the Medical Register.

4. **Dangerous Drugs.** The contravention by a registered medical practitioner of the provisions of the *Dangerous Drugs Acts* and the Regulations made thereunder may be the subject of criminal proceedings, and any conviction resulting therefrom may be dealt with as such by the Council under the powers given them by Section 29 of the *Medical Act*, 1858. But any contravention of the *Acts* or the Regulations, involving an abuse of the privileges conferred thereunder upon registered medical practitioners, whether such contravention has been the subject of criminal proceedings or not, will, if proved to the satisfaction of the Council, render a registered medical practitioner liable to have his name erased from the Medical Register.

5. **Association with Unqualified Persons.** Any registered medical practitioner who, whether by administering anæsthetics or otherwise, assists an unqualified or unregistered person to attend, treat, or perform an operation upon any other person, in respect of matters requiring professional discretion or skill, will be liable on proof of the facts to have his name erased from the Medical Register.

6. **Advertising and Canvassing.** The practices by a registered medical practitioner :

(*a*) of advertising, whether directly or indirectly, for the purpose of obtaining patients or promoting his own professional advantage ; or for any such purpose of procuring or sanctioning or acquiescing in the publication of notices commending or directing attention to the practitioner's professional skill, knowledge, services, or qualifications, or depreciating those of others ; or of being associated with or employed by those who procure or sanction such advertising or publication; and

(*b*) of canvassing or employing any agent or canvasser for the purpose of obtaining patients ; or of sanctioning or of being associated with or employed by those who sanction, such employment ;

are in the opinion of the Council contrary to the public interest and discreditable to the profession of medicine, and any registered medical practitioner who resorts to any such practice renders himself liable on proof of the facts to have his name erased from the Medical Register.

7. **Association with Uncertified Women practising as Midwives.** It has come to the knowledge of the Council that certain registered medical practitioners have from time to time, by their countenance or assistance, or by issuing certificates, notifications or other documents of a kindred nature, enabled uncertified persons to attend women in childbirth otherwise than under the direction and personal supervision of a duly qualified medical practitioner contrary to law.

Inasmuch as such conduct is in the opinion of the Council discreditable to the profession of medicine, and calculated to defeat the purpose of the Statutes made in the public interest for the protection of mothers and infants, the Council has given notice that any registered practitioner who is proved to have so offended will be liable to have his name erased from the Medical Register.

The Council point out that it must be clearly understood that the instances of professional misconduct which are given do not constitute, and are not intended to constitute, a complete list of the offences which may be punished by erasure from the Medical Register; and that by issuing the Notice they are in no way precluded from considering and dealing with any form of professional misconduct (as, for example, immorality involving abuse of professional relationship) which may be brought before them, although it may not appear to come within the scope or precise wording of any of the categories therein set forth. Circumstances may, and do arise from time to time in relation to which there may occur questions of professional conduct which do not come within any of these categories. In such instances, as in all others, the Council have to consider and decide upon the facts brought before them.

MALPRAXIS, ADMINISTRATION OF ANÆSTHETICS, QUACKERY, NEGLECT

MALPRAXIS

The question of malpraxis is very wide and cannot be discussed exhaustively here. It is advisable, however, to consider what is the law upon the subject and to illustrate the position by a few examples.

What amounts to Negligence. Negligence is not a statutory offence; it is part of the common law of England; moreover, there is no special law of negligence applicable to medical men in contradistinction to other persons. In each case it is for the court to determine whether the facts amount to negligence. Negligence has been defined by a high judicial authority as being simply neglect of some care which we are bound to exercise towards somebody.

Gratuitous Treatment. When a medical practitioner undertakes orally to treat a patient gratuitously, an action for damages *in tort* will lie if the treatment be given negligently: for although no action will lie for not giving the treatment (there being no consideration for the promise), the law imposes a duty to take care to use such skill as one possesses or even professes to possess.

In *Ball* v. *Howard*[1] a medical practitioner was sued for damages for negligence in the performance of an operation for appendicitis. It was alleged that the physician had neglected to call in a specialist when requested by the patient. The judge found that the physician's conduct was, in general, worthy of the profession of which he was an honourable member, but that, contrary to his usual practice and habit, he had committed two serious errors of judgment: (i.) in not attending at once to the patient's call; and (ii.) by going away without leaving proper instructions what to do. The patient having suffered no permanent harm, judgment was given for him for 70*l.* damages, and judgment was given for the physician in respect of his fee of thirty guineas.

In *R.* v. *Bateman*[2] a medical practitioner was prosecuted for manslaughter where death followed the removal of the uterus in the course of delivery by the accused following a complex presentation. It was alleged that the accused took no steps to have the patient taken to a hospital until some days after the removal of the uterus. The Court of Criminal Appeal decided that to support an indictment for manslaughter the prosecution must prove not only the facts necessary to establish civil responsibility (*i.e.*, that if a person holds himself out as possessing special skill and knowledge, and he is consulted as possessing such skill and knowledge by or on behalf of a patient, he owes a duty to the patient to use due caution and diligence, care, knowledge and skill in administering the treatment), but also that the negligence or incompetence of the accused went beyond the mere matter of compensation, and showed such disregard for the life and safety of others as to amount to a crime against the State and to be deserving of punishment.

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[1] *Lancet*, 1924, 1, 253.

[2] [1925] 28 Cox, C. C., 33. For a case in the Isle of Man where a medical man was acquitted on a charge of manslaughter in connection with the death of a woman whom he had attended for a confinement, see *B.M J.*, 1930, 2, 925.

Recovery of Fees. It was decided long ago[1] that if the patient receives no benefit, *in consequence of the practitioner's want of skill*, the latter cannot recover his fees ; but the remuneration of a practitioner who has used due skill and diligence does not depend upon his effecting a cure. In the case of a surgeon, if an operation which might have been useful has been unsuccessful, he is nevertheless entitled to charge ; but, if it could not have been useful in any event, he has no claim.[2]

Who is the Person Responsible. By the fact of his registration under the Medical Acts a presumption arises that a qualified medical man knows his work and does it properly, and he has no need to adduce evidence of general skill and fitness ; he is held *prima facie* to be competent in any lawful act, and the onus of proof to the contrary lies on the one who alleges it ; if he poses as a specialist, a greater competence will be presumed ; and yet considerable latitude in the practice of any theory or line of treatment will be allowed. This latter statement is based upon the Medical Acts of 1858 and of 1886, under which the General Medical Council is entrusted with the responsibility of setting up a standard of proficiency in general professional knowledge : but it cannot refuse recognition to a duly qualified practitioner because he upholds or professes or refuses to uphold and practise certain lines of treatment. If the court decides, after hearing the evidence, that a medical practitioner has been guilty of a culpable lack of attention, an absence of due care and caution or competent degree of skilful knowledge, and, on that account, has caused needless injury and loss to his patient, damages may be awarded against him.

In *Gerber* v. *Pines*[3] it was held that a surgeon was negligent in the performance of his duty to his patient in not informing her that a hypodermic needle had (without any negligence on his part) broken during an injection into her gluteus maximus, and had been left in the muscle. Nominal damages were awarded.

A qualified assistant or locum tenens is personally responsible for any negligence which may be proved in his practice ; he does not involve his principal. The matter is more complicated where unqualified assistants (students, nurses, etc.) are concerned. If the principal superintends the alleged negligent act of the assistant, he is liable ; but if, in his absence, the subordinate omits to take some precaution in a matter which is within, or in acting goes beyond, the scope of his specific employment or directions, the principal will not be liable. A principal is not jointly liable for his assistant's criminal acts, unless he authorises them or co-operates in their execution.

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[1] *Kannen* v. *McMullen*, Peake, 59

[2] Alderson, J., in *Hill* v. *Featherstonhaugh*, 7 Bing. 574.

[3] 78 Sol. J., 13, *B.M.J.*, 1935, 1. 42.

Who may sue for Damages for Negligence. If a man employs a physician or a surgeon to attend to his wife or child, and by reason of negligence on the part of the physician or surgeon, the patient suffers injury, the man can sue the physician or surgeon for damages for breach of contract. Apart altogether from the duty owed by the physician or surgeon to treat the patient with care and skill under the implied terms of the contract between him and the man who employed him, the physician or surgeon owes a duty to the patient to take care, by reason merely of the subsistence of the relationship of medical practitioner and patient; and, in respect of any breach of this duty, the patient can sue *in tort* for damages for negligence.[1]

Hospitals. The legal position of the governing body of a public hospital was considered by the Court of Appeal in *Gold* v. *Essex County Council*[2] where the earlier decision of the Court of Appeal in *Hillyer* v. *St. Bartholomew's Hospital*[3] was reviewed. It has now been held that the obligations undertaken by those in control of a hospital in regard to a patient therein are not confined to the provision of skilful nurses, or skilful persons, such as radiographers, for giving the patient prescribed treatment. The obligation which they undertake is that of nursing or treating the patient, as the case may be. Accordingly, they will be liable for the negligent act of a nurse committed, whether in the course of actually nursing the patient, or while performing some purely administrative duty such as serving his meals, which is merely incidental to the primary task of nursing, or for the negligent act of a skilled person, such as a radiographer, committed in the course of administering treatment properly prescribed by a medical practitioner.

The nature of the work of consulting physicians and surgeons and the relationship in which they stand to a hospital authority are such that the latter cannot be held to undertake responsibility for their negligent acts. The question whether the same is true of house physicians and surgeons is doubtful.

In the opinion of Lord Greene, M.R., the true ground on which a hospital escapes liability for the act of a nurse who, whether in the operating theatre or elsewhere, is acting under the instructions of a surgeon or physician is not that *pro hac vice* she ceases to be the servant of the hospital but that she is not guilty of negligence if she carries out the orders of the surgeon or physician, however negligent those orders may be. There is no reason, on principle, why, if she carries out an order negligently, the hospital authorities should not be liable.

Some important observations were made by Lord Greene and by Goddard, L.J., in the *Gold* case as to the position of local authorities who provide hospital accommodation in accordance with Part VI of the Public Health Act, 1936.

Gladwell v. *Steggall*, 5 Bing, N. C., 733; *Pippin* v *Sheppard*, 11 Price, 400.

[2] 58 T.L.R. (1942), 357.

[3] [1909] 2 K.B., 820.

The House of Lords held in *Strangways-Lesmere* v. *Clayton*[1] that where two nurses, acting on a surgeon's orders, negligently administered to a patient six *ounces* in mistake for six *drachms* of paraldehyde, in consequence whereof the patient died, the nurses alone were responsible and not the hospital authorities.

There is a distinction between "matters of professional skill" and "purely ministerial or administrative duties." The governors of a hospital are not responsible for the discharge of skilled duties; but they are responsible for the discharge of administrative duties. The distinction between these two classes of nursing duties was considered by the House of Lords in *Anderson* or *Lavelle* v. *Glasgow Royal Infirmary*.[2]

In *Weigall* v. *Westminster Hospital*[3] the mother of a patient was awarded £2,826 damages for personal injuries suffered as the result of her slipping on a mat which had been placed on a floor in the hospital covered with highly polished linoleum. The Court of Appeal held that the Hospital authorities had not taken reasonable care to prevent damage from unusual danger.

Nursing Homes and Nurses. If the proprietors of a nursing home, sanatorium, or other similar institution undertake to nurse or to treat patients, the nurse or medical practitioner who carries out the nursing or treatment is the agent of the proprietors; and the latter are responsible for every act of negligence which the nurse or medical practitioner may commit.

In *Lindsey* v. *Marshall*[4] the House of Lords held that a patient in a maternity home was entitled to recover damages for negligence on the part of the governing body of the home on the ground that the staff of the home after an outbreak of puerperal fever had admitted patients before having ascertained whether any of the staff were carrying infection of puerperal fever.

In *Powell* v. *Streatham Manor Nursing Home*[5] the House of Lords in 1935 restored a judgment for £3,477 damages awarded against a nursing home in respect of negligence in the treatment received by a married woman in connection with an operation for hysterectomy performed while she was a patient in the home.

Physicians and surgeons are not responsible for the negligent acts of nurses whom they have good reason for believing to be competent, unless they are present at the performance of the act complained of, and are able to exercise control. It is always a question of fact whether a particular duty properly falls within the scope of a nurse, having regard to the practice in the institution concerned and in the profession generally.

Contributory Negligence by Patient. Of the cases of contravicarious responsibility, *i.e.*, cases in which the practitioner seeks to throw the onus upon the patient, because the latter did not follow instructions, and thus caused the injury or delayed recovery, it would seem that natural justice would not suffer a practitioner to be held responsible for a patient's disobedience of instructions given solely for his own benefit.

The actual errors of practitioners fall naturally under one of two headings, *viz.*, omission, or commission: but it is obvious that in some cases very definite lines of treatment, often in opposite directions, have to be pursued on the basis of diagnosis; the two cannot therefore be altogether separated in practice.

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[1] [1936] W.N. 244.

[2] *B.M.J.*, 1933, 1, 767.

[3] (1936) 52 T.L.R., 301.

[4] [1937] A.C., 97.

[5] *The Times*, March 1st, 1935.

Negligence by Omission. If a medical practitioner, after having actually undertaken the treatment of a patient, wickedly neglects him, and the patient dies in consequence of such neglect, the practitioner will be guilty of manslaughter (see *R.* v. *Bateman* (*supra*)).

The most frequent cases are those where damages are claimed for permanent disability or disfigurement; and occasionally such a claim is made in order to justify a refusal to pay fees for medical treatment.

A physician who holds himself out as having special knowledge and skill in the treatment of particular diseases is bound to bring to the discharge of his duty not merely the average degree of skill possessed by general practitioners, but that special degree of skill and knowledge possessed by physicians who are specialists in the treatment of such disease in the light of the present state of scientific knowledge. The question when a physician becomes a specialist is not one of law, but one of fact primarily for his own determination; but, when he holds himself out as a specialist, it becomes his duty to use that degree of skill which such a practitioner should possess.[1]

In America the rule appears to be that a physician and surgeon when employed in his professional capacity is required to exercise that degree of knowledge, skill and care ordinarily evinced by physicians and surgeons practising in similar localities.

In a case where the plaintiff, under the direction of the defendant, assisted in dressing a wound of her husband and became infected with the poison by reason of slight scratches on her fingers, the defendant, who knew of the danger, was found guilty of negligence in assuring her that there was none, since he was not justified in assuming that her hands were free from such wounds. In another extraordinary case it was held that a physician is under no obligation while a person is his patient to tell her or her husband that a fragment of a needle, broken in a surgical operation, was left in her body, but it is his duty to tell her so when discharging her as his patient from his care.

These principles are still generally recognised in the English courts.

In *Morris* v. *Winsbury-White*[2] a surgeon was sued for damages for negligence in an operation for the removal of the prostate gland. After the operation the patient remained in hopsital and was attended by the resident hospital staff. The treatment involved the insertion of tubes into the bladder and the frequent replacement thereof. An X-ray photograph revealed that a portion of a tube was in the patient's bladder. The Court held that the said portion had not been left there by the surgeon, and that the doctrine of *res ipsa loquitur* did not apply to the finding of a tube which had been left in the body after an operation.

Errors in Medical Diagnosis. Of the errors in diagnosis in ordinary medical work made by practitioners the law knows very little; for it is very rarely that they result in litigation. Since the notification of infectious diseases has become compulsory, several cases of alleged negligence in regard to the diagnosis of these diseases have been brought into court either by aggrieved victims of the error or by the authorities responsible for recording notifications.

The remarks of the magistrate in the following case seem fairly accurately to represent the view which courts are likely to take of such cases:

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[1] *B.M.J.*, 1903, 2, p. 875.

[2] (1937) 4 All E. R. 494.

A medical man in practice at Battersea, appeared at the South-Western Police Court in answer to a summons for failing to notify a case of small-pox. There was no doubt as to the fact that a case of small-pox had been treated by the physician as chicken-pox, and that, in consequence of this mistake, other persons had become infected ; but considerable doubt arose whether the defendant was aware of the nature of the disease to such an extent as to render him liable to conviction. It was suggested by the Battersea Borough Council, acting as the prosecutors, that as the physician apparently felt some doubt in the matter, he should have "taken advantage of the expert provided "—namely, the district medical officer of health—and that by failing to exercise all reasonable skill he was guilty of negligence. The magistrate who heard the case differed from this view, and refused to accept the contention that because he might have felt a doubt, the physician should have notified the case as one of small-pox. The magistrate pointed out that if a medical man, acting upon suspicion, caused the removal to a small-pox hospital of a man suffering from chicken-pox, the consequences would be very serious. He held that a medical man could not be expected to do more than to act to the best of his judgment ; and, having acquitted the defendant of all negligence, he dismissed the case.[1]

The suggestion that the medical officer of health is provided as an expert whom medical men can consult in cases of doubt where dangerous infectious disease is suspected is clearly wrong. This is not the legal position of the medical officer of health : and, so long as his duties remain what they now are, any assistance which he may afford in this way must be purely voluntary. To compel his attention, and to obtain his opinion by notifying a case which may turn out not to be one of the disease suspected, is a course which any medical man would properly hesitate to take. The question of how far a medical officer of health should render assistance upon such occasions was dealt with at some length in the *Lancet* of October 12th, 1901, p. 987, the occasion being the publication of some correspondence which had taken place between a medical man and a medical officer of health upon this subject. In the course of that correspondence, the latter wrote : "I am always pleased to assist my medical *confrères*, but you must understand that the diagnosis of cases is no part of the duty of a medical officer of health. The responsibility of diagnosis rests with the medical attendant entirely." This, we think, is a correct statement of the position. Whether some method should be devised to enable a medical practitioner to obtain the opinion of one more experienced than himself in the case of such a disease as small-pox is another matter. The power to do this would be a source of protection both to him and to the public.

Errors in Surgical Diagnosis. These are pre-eminently the cases which result in litigation and are those in which errors of diagnosis must almost inevitably result in, or be responsible for, errors in treatment. The most common type is that in which dislocations are described as fractures and fractures as dislocations : where it is alleged that the treatment has been incorrect and has resulted in the deformity of a limb or in the limitation of mobility of a joint. In many of the cases, even with the best, most skilful, and patient treatment, something in the way of detriment is almost inevitable ; and, unless the practitioner is careful in regard to the management of the patient and his friends, more so perhaps even than in regard to the treatment of the injury, trouble may arise.

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[1] *Lancet*, 1903, 2, p. 1380.

The following is a typical case[1] :—

Thomas Webster, a collier, sued Dr. W. C. Rainsbury for damages for alleged unskilful treatment.

The plaintiff was a pitman employed at the Silverhill Colliery at Teversal. On November 26th he met with an accident whereby he sustained an injury to his left arm. He thereupon consulted the defendant, who was medical officer to the sick club of which the plaintiff was a member. According to the plaintiff's case the defendant, after examining the arm, said that no bones were broken, and merely prescribed bathing and painting with iodine to reduce the swelling. In the following January the plaintiff consulted a lamp cleaner at a neighbouring colliery who had a reputation as a bonesetter. He also consulted another bonesetter. According to the plaintiff's case neither of these bonesetters would undertake his case as each said that the elbow was dislocated, and that, as the injury was of old standing he could not do anything with it. In the end, about a year after the accident, the plaintiff went to Charing Cross Hospital, where Mr. Charles Gibbs performed an operation. The negligence alleged was in allowing the plaintiff to go about for six weeks with a broken arm.

The defendant said that when the plaintiff came to him he complained of a swelling in the left arm. He had been unable to complete the diagnosis at the time owing to this. The plaintiff never told him that he had been to the bonesetters, and never complained of improper treatment.

In the opinion of the Judge a country doctor was not expected to have so much skill as the surgeon of a London hospital. He was expected to have reasonable skill, and to exercise reasonable care in the treatment of his patients. The important question for them to determine was whether the defendant had reduced the dislocation. There was a difference of opinion as to the swelling, but the doctors all agreed that the swelling made a diagnosis difficult. The plaintiff said that the defendant told him there was no dislocation, but the defendant denied this. The evidence was that the plaintiff came up daily to see the doctor. The arm was out early in January ; after the lapse of such a long time as that resetting had become impossible. In serious cases it was the duty of a country doctor to send his patients to a hospital Here the defendant said he had sent him, but the question was whether he had sent him early enough.

The jury awarded the plaintiff £25 damages.

A case of somewhat similar nature occurred some years ago :—

In a bicycle accident a man sustained, among other injuries, damage to his shoulder. The medical man asserted that he examined the shoulder carefully and failed to detect any dislocation until some time after the accident. The witnesses for the patient stated that the examination was careless, having been made with the coat still on. Two eminent surgeons gave evidence that, if the dislocation had been present at first, it would have been detected by the medical man, and also that it might have occurred some time subsequently to the accident. The patient lost his case.

So far as the courts are concerned the results are determined by the general principles already enunciated, *i.e.*, by evidence as to care and average skill.

In every case where there is difficulty in diagnosis, and in every case where the patient has sustained some violence which might possibly have caused fracture or dislocation, the practitioner who does not have an X-ray examination made exposes himself to an unnecessary risk. Moreover if there is any doubt about the diagnosis in such a case the practitioner should have a consultation with a surgical colleague, or if that is not desired send the case to hospital.

For further remarks on the X-rays applied to such conditions, *vide* below, p. 72.

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[1] *B.M.J.*, 1902, 2, p. 295.

Refusal to Continue in Attendance. A dissatisfied patient will sometimes allege that refusal to continue in attendance constitutes negligence. The question must arise occasionally whether the practitioner is under a duty to continue with a case after he has seen the patient once. Continued attendance may, in some cases, prove very irksome, especially if the patient lives at a distance and is not a regular patient. The following Scottish case seems to indicate that, although a medical man is not bound to continue attendance, damages may sometimes be awarded against him.

The practitioner, as the nearest medical man, had been called in to attend a labourer who had sustained a fracture of the right tibia just above the ankle. Upon examination, the practitioner found that the man was not in a fit state to have the leg set, and for several reasons he advised that he would be better at the Edinburgh Infirmary, six miles off. Having done up the patient's leg so as to guard it against the dangers of travelling, he sent him to hospital, intimating at the same time that he would have nothing more to do with the case. He was not the regular attendant of the patient, nor was he the surgeon for the mill at which the patient had been working. Further, the practitioner never entered the patient's name in his books, nor did he ask any fee for what he had done. After seeing the patient the practitioner was himself laid up with influenza for a month, when he again saw the patient, who had never been moved to the hospital. By that time the mischief had been done, and as the result of an operation which was then found necessary one leg was shorter than the other.[1]

Lord Adam, who charged the jury in an action brought for negligence against the practitioner, said that the case turned altogether on the question whether the practitioner had undertaken to give his continuous professional attendance to the patient. He remarked also: "Because a doctor attends a man in an emergency, it does not follow that he is bound to go on with the case. Unless it is proved that, besides doing what he did, he also undertook to treat the pursuer as his patient, the obligation ceased." In spite of this very explicit direction, the jury awarded the patient 50*l*. damages. Although the jury decided in favour of the patient, the direction of the learned judge in the above case represents an accurate statement of the law, and it corresponds with the attitude taken up by American courts.

In *Keller* v. *Lewis*[2] a physician gave his services gratuitiously to a patient who knew that he was going away. It was held that he was responsible only for such treatment as he had administered personally, and that he could not be held liable for any negligence or want of skill on the part of a physician who was called in subsequently.

Errors of Commission. The general rule applicable in such cases is "the practitioner must take sufficient care over the case and give it proper attention." This rule applies in cases where diagnosis has been incomplete or inaccurate, and wrong treatment in consequence has been applied, for instance :—

In Australia a surgeon was sued for negligent and unskilful treatment of a fractured elbow-joint. The alleged want of skill consisted in the arm having been kept in rigid splints for twelve days before passive motion was commenced. The surgeon stated that he kept the splints on because the joint was too inflamed to be moved, and that the boy could not move his arm through an angle of 45 degrees. Several medical men gave evidence for the surgeon, and stated that there was no evidence of any malpractice or negligence. Nevertheless the jury awarded the plaintiff £200 damages.

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[1] *B.M.J.*, April 7th, 1894, p. 755.

[2] 65 Ark, 578.

Charges of manslaughter have been brought against medical practitioners in cases of midwifery. In some instances gross mismanagement has been proved; the uterus and even parts of the viscera have been torn away, and in such cases convictions have followed.[1] It is well known, however, that much difference of opinion exists among the most eminent practitioners of midwifery respecting the treatment to be pursued in difficult cases.

Dental Cases. Dentists are not infrequently proceeded against directly (or by a counter-claim set up against a bill) for negligence in breaking off a portion of the jaw in tooth extraction, but such cases as the following are very unusual :—

A claim for damages was brought against a consulting dental surgeon at the Cardiff Infirmary for alleged unskilful extraction of a tooth. The tooth in question was an upper canine; and it was alleged that " unnecessary force was used, with the result that the tooth was forced upwards into the cavity of the cheek, and became embedded in the cheek-bone and the cartilage of the nose, just below the lachrymal duct." It appeared that the tooth was not extracted; but that the forceps slipping over the conical part of the tooth, forced it up under the skin near the corner of the eye. Swelling and pain followed; and the patient was seen by several medical men who at first failed to diagnose the unique condition, and were, morever, misled by the statement of the patient that the tooth had been extracted. The use of the Röntgen rays, however, clearly demonstrated the condition, and the tooth was removed by a simple skin incision. The evidence of the four medical men who examined the patient was against there having been any negligence in the attempted extraction, although it appears that the dentist in question had not ascertained whether the tooth was out or not.

The judge held that if there was no negligence in the operation proper, it was immaterial that there was failure to find the tooth. The claim failed.

In another case a woman went to a dentist to have a tooth extracted by the dentist's " painless process." The operation was not successful, for broken pieces of the tooth were left in the patient's jaw. It was held that a cause of action *in tort* lay against the dentist in respect of the breach of his duty to use proper skill in the practice of his profession, irrespective of the contract to perform the operation by a " painless process."[2]

If a dentist acts in conjunction with a medical practitioner, it is no part of the dentist's duty to discover the general health of the patient. It is not negligent for a medical man to allow the extraction of many teeth to be made without making a preliminary blood test. (*Warren* v. *Greig*[3]; and *Warren* v. *White*[3]).

Negligence in Operations. It is only on rare occasions that a recognised surgeon is charged with negligence in the performance of an operation. General practitioners should, of course, be careful not to undertake operations which are beyond their skill.

Allegations of negligence are made most frequently in cases where the surgeon has either exceeded the limit of a permitted operation or has left instruments or other foreign bodies in a wound.

Exceeding the Limits of a permitted Operation. If during an operation an unforeseen extension is seen to be inevitable, *e.g.*, the compulsory amputation of the leg when by mishap the popliteal artery is damaged during an arthrectomy, proof that such was in the opinion of the surgeon honestly necessary for the life or health of the patient would be sufficient to exonerate him.

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[1] See *R.* v. *Bateman*, *supra*. In this case the greater portion of the uterus was removed in extracting the placenta, and the bladder ruptured as well as the rectum. The physician was convicted of manslaughter in the Central Criminal Court, but this conviction was quashed on appeal.

[2] *Edwards* v. *Mallan* (1908) 1 K. B. 1002.

[3] *Lancet*, 1935, 1. 330.

In an unreported case the plaintiff, who was a nurse, alleged that she had expressly forbidden the removal of both ovaries, although she had consented to the removal of one. The surgeon's contentions were:—

1. The operation had been left to his discretion, based upon the result of his exploration.

2. The double ovariotomy was necessary at least in order to prolong the nurse's life, if not to enable her to escape imminent danger.

3. The operation was not the cause of her sterility, as she was necessarily already sterile from her cysts.

The jury decided in favour of the surgeon, and added that, in their opinion, " an action ought never to have been brought." This decision was upheld by the Court of Appeal.

Several practical points are presented by this case :

1. It is advisable to have a definite understanding, in writing if possible, as to the scope and possible results of one's operative treatment, and it is preferable to have it stated clearly that the matter is left to one's discretion to act when one has gained full information. This is particularly important where a series of operations or examinations under an anæsthetic is required.

2. If one's patient is " under," and one sees that one must exceed the limits of one's permission, one should consult with the nearest relative at hand, or else be able to rely on the extreme necessity of the case before proceeding.

3. It should always be remembered that one is operating upon a possible plaintiff.

Foreign Bodies left in the Wound or Abdominal Cavity. Since the South African case of *Van Wyk* v. *Lewis* (1924),[1] the English Court of Appeal in 1939, in *Mahon* v. *Osborne*,[2] has considered the duty of a surgeon in cases where a foreign body has been left in the wound after an operation. The patient's mother brought an action for damages against the surgeon who performed an operation for the removal of a duodenal ulcer. A swab which had been used by the surgeon to pack off adjacent organs was left in the patient's body, with the result that he died three months later. It was held that there was no general rule of law which required a surgeon at the end of an operation of this kind, after removing all the swabs of which he was aware, to make sure that no swabs had been left in the patient's body, and that the question whether or not the omission by the surgeon to remove a swab constitutes failure by him to exercise reasonable skill and care must be decided on the evidence given in the particular case.

In an earlier case (*Crotch* v. *Miles*)[3] Miss M. H. G. Crotch brought an action for damages against Mr. W. E. Miles for injury alleged to have been caused by the surgeon's having left a pair of forceps in her abdomen after an operation in November, 1920, for the removal of a fibroid tumour. The case was heard by the Lord Chief Justice of England and a special jury. After a long summing-up the Lord Chief Justice left three questions for the decision of the jury, *viz.* :—

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[1] See article in *B.M.J.*, 1933, 1, p. 1027.

[2] (1939) 2 K. B. 14.

[3] *B.M.J.*, 1930, 1, p. 620.

1. Is it established that the forceps were left in the plaintiff's body in the course of the operation performed by the defendant ?

2. If so, was that fact due to negligence on the part of the defendant, or for which he was responsible ?

3. The question of damages, if it arises.

The jury were absent only ten minutes, and they answered in the negative the first question left to them. Judgment was entered for the surgeon, with costs.

The courts seem unwilling to hold the surgeon responsible unless there is proof that he was personally negligent. (See *Morris* v. *Winsbury-White* (*supra*).)

X-Rays in Diagnosis and Treatment. This method of investigation and treatment of certain affections has become so important that every practitioner should have a clear idea of the value of X-ray examination and treatment in various conditions, and make sure that his patients are advised to make use of them in suitable cases. Neglect of this has led to actions for malpraxis on many occasions.

This is not the place in which to discuss the clinical value of X-rays, but their value in the diagnosis of bone injuries and displacements, in disease of bones, in head injuries, etc., is common knowledge, as is their importance in diagnosing and defining the position of foreign bodies in the tissues. They are also invaluable in the diagnosis of disease in many of the viscera by the injection of substances opaque to the rays and in the treatment of certain diseases of the blood, glands and skin. Deep X-ray therapy for the treatment of malignant disease is also in common use.

The rays are capable of causing profound changes in the blood and tissues, of producing severe dermatitis or burns of a most intractable nature, and even of a malignant condition of the skin. They must, therefore, be used with due care and by persons skilled in their application.

Negligence in Treatment by Artificial Light. Ultra-violet light differs considerably from sunlight in its wavelength. Ordinary visible light has a wavelength varying from 7,000 Angström units at the red end of the spectrum to 4,000 A.U. at the violet end, whereas ultra-violet light comprises wavelengths from 4,000 to 2,000 A.U.

In sunlight the spectrum ends at about 3,000 A.U., and therefore its ultra-violet radiation is comprised entirely of rays between 4,000 and 3,000 A.U., and the body has become accustomed to these rays.

In the mercury vapour lamp and similar sources of artificial sunlight there is a considerable proportion of light of shorter wavelengths, *e.g.*, 3,000-2,000 A.U.

The body is unaccustomed to light of this nature, and therefore, unless the radiation is properly controlled, there is great danger of injury to the patient.

The use of this light however for the treatment of various local and systemic diseases has reached a stage where the control of such treatment is passing from the hands of specialists into the hands of the untrained and unqualified. It is to be expected, therefore, that burns and other injuries will become more common. An old man who was in the habit of giving himself an " artificial sunbath " went to sleep under the rays for an hour and ten minutes. As a result there were severe burns and general disturbances, from which the man nearly died.

In *Anderson or Lavelle* v. *Glasgow Royal Infirmary* (*supra*), a woman under treatment by ultra-violet light was placed in the light room and ordered to walk about until she was told to come out. She remained there for forty-five minutes, and as nobody came to her she walked out herself. As a result of the prolonged exposure (the usual time for a first exposure was ten minutes) she was badly burned, and brought an action for damages against the institution. The case came before the Court of Session and the House of Lords; and judgment was given in favour of the hospital.

Negligence in Promoting Drug Habits. The case of *Forsythe* v. *Law*[1] should be regarded by all medical men who have dealings with patients addicted to drug-taking as a warning against doing anything which could possibly be made the basis of an accusation that they were lending their aid to a continuance of the habit. (See also "Dangerous Drugs" in Vol. II.)

Negligence in Cases of Criminal Wounding. Inasmuch as on the death of the victim within a year and a day after the wounding[2] the assailant must be charged with murder or manslaughter, the question of medical negligence may assume great importance, for it may be alleged that death would not have occurred if the case had not been treated improperly by a medical man.

In these circumstances the question may arise as to how far the treatment aggravated the effects of the violence; and the court may have to decide, from the evidence of a medical witness, as to the degree of criminality which attaches to a prisoner. If, for instance, an ignorant person removes a clot of blood, which sealed up the extremity of a blood-vessel, and as a result fatal bleeding ensues, or death is caused by unnecessarily interfering with a penetrating wound of the chest or abdomen; it would not be just to hold the aggressor responsible for homicide.

A serious responsibility rests upon practitioners who undertake the treatment of cases of criminal wounding. Any deviation from common practice therefore should be made only with the greatest caution. Upon these occasions every matter connected with the surgical treatment will be the subject of rigorous inquiry and professional criticism. In the case of a severe lacerated wound in the hand or foot, it may be alleged that the wounded person would not have died if amputation had been performed at once. A practitioner may be able to justify himself by showing either that the injury was too slight to require amputation, or that the health of or other circumstances connected with the deceased would not allow of its being performed with any reasonable hope of success. On the other hand, if the practitioner performed amputation, and the patient died, then it might be urged that the operation was unjustifiable and that it had caused death. Here the surgeon is bound to show that the operation was necessary, according to the ordinary rules of practice. The treatment of severe incised wounds of the throat, when the windpipe is involved, sometimes places a practitioner in an embarrassing position.

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[1] Commented on in the *Lancet* of March 8th, 1902, p. 680.

[2] This refers to the Law of England; under Scots Law the lapse of time between the infliction of an injury and the death of the victim does not alter the responsibility of the assailant if it can be shown that the death was undoubtedly due to the injury.

If the wound is left open, death may take place from bleeding; if it is prematurely closed, blood may be effused into the windpipe and cause death by suffocation.

Lord Hale drew a very nice distinction between death resulting from a wound rendered mortal by improper treatment and death resulting from improper treatment, irrespective of the wound. In most cases such a distinction could scarcely be established, except upon speculative grounds, and in no case, probably, would there be any unanimity in the opinions of medical witnesses. In slight and unimportant wounds, it might not be difficult to distinguish between the effects resulting from improper treatment and those connected with the wound, but there can be few cases of severe injury to the person wherein a distinction of this nature could safely be made. The probability is, that no jury would convict of murder if the medical evidence showed that the wounding was not originally mortal, but became so only through unskilful or improper medical treatment. In such a case it would be impossible to ascribe death to the wounding, or to its usual or probable consequences.

If death had been caused by the wounding, it is immaterial that in more favourable circumstances, and with *more skilful treatment*, a mortal result might have been averted.

The true distinction in all such cases is, that if the death is occasioned by grossly erroneous medical treatment, the assailant will not be guilty of felonious homicide, but if death is the result of lack merely of that higher degree of skill which is normally available only in great towns, the assailant will be responsible, because he has wilfully exposed the deceased to a risk from which he has practically no means of escaping.

If the wounding had not been likely to produce death, but, through unskilful treatment, death ensued, that would not be felonious homicide.

During a quarrel a man received a bite on the thumb. He went to a quack, who applied some irritating ointment, which led to severe inflammation, and this rendered amputation of the arm necessary. He died from the effects of the operation. Medical evidence was given that the injury caused by the bite was slight, and would probably have healed but for improper treatment. On this evidence the biter was acquitted.

Where, owing to improper treatment of the injured part, an operation became necessary, and resulted fatally, the assailant would probably not be guilty of murder. Much discussion has arisen on this question, and many theoretical cases have been enunciated, *e.g.*, What if the fatal condition was not *propter*, but merely noticed *post*, the alleged injury (*e.g.*, an aneurysm first noticed after a blow may be mistaken for an abscess and may be opened with fatal result)?

Thanks to the increase in skill on the part of medical practitioners and the increase in the number of hospitals in Great Britain, cases of improper treatment are becoming very rare; but they are allowed to remain in this work because they are still important in places where such facilities may be lacking.

For an interesting case of death under an anæsthetic after criminal wounding, *vide* p. 78. In the paragraph referring to violent deaths there are also some further observations on the subject.

ADMINISTRATION OF ANÆSTHETICS

There is no case recorded in which a civil action or a criminal proceeding has been taken successfully against a medical man in respect of a death from general anæsthesia.[1]

The following propositions indicate the chief questions which arise in this connection :—

1. No one but a properly qualified person should be allowed by law to give a general anæsthetic.

This proposition is generally agreed, but differences of opinion have arisen as to who is " properly qualified," some holding that the term should include only registered medical practitioners ; others, on the other hand, hold that dentists should be allowed to administer a general anæsthetic, at any rate, nitrous oxide gas. For our part we would prefer our own choice of words, leaving it to any individual to prove that he was " properly qualified " by evidence as to his education and experience in anæsthesia, and also as to the circumstances under which he administered the anæsthetic in question, and then let the court decide as to whether he acted with " reasonable skill and care."

2. Is it necessary that an inquest should be held in every case in which anæsthesia is the alleged cause of death ?

If a death takes place as the result of anæsthesia (general or local) the death cannot be natural ; and in strict law an inquest may be required. There is a tendency among some coroners, however, to avoid inquests in such cases, if possible, where there is no suggestion of malpraxis, overdose, or other matter that may need public investigation, including any complaint that may be made by the relatives of the deceased. It used to be said (as a sort of working rule) that if a patient died on the operating table, the death should be reported to the coroner, whereas if the death took place outside the operating theatre, or in the ward, the coroner need not be informed. Whatever may have been considered justified in the past, it must be realised that there are now in use anæsthetics and other drugs of greater variety and power. Thus a death that takes place in a ward some time after an operation may be due to, or be contributed to, by one of the drugs of the barbituric group : new anæsthetics tend to be used to permit operations in cases in which there was no such possibility when chloroform or open ether were the only anæsthetics in general use. The real test logically should be whether death was caused or accelerated by the anæsthetic used. At the same time, there is a tendency among some coroners to avoid inquests if they can ; the responsibility rests with the coroner, and if he finds that a surgeon or an anæsthetist is trying to avoid sending a report to him of a case that he thinks should be reported, he is unlikely to adopt any co-operative attitude.

Some coroners, as a means of obtaining preliminary information for themselves issue a form of questionnaire for the anæsthetist and or the medical man in charge of the case to fill up. The questions vary and at times some very pointed examples have been met with, such as an inquiry as to how many previous fatalities the medical man or anæsthetist has had in the past. There can be no compulsion in the answering of questions put in this manner; in some instances it might be a source of danger, since the form could be used in evidence against the medical man or anæsthetist possibly in criminal or in civil proceedings. At the same time it may considerably aid the coroner to appreciate the particular facts surrounding a death if he were provided with a simply worded synopsis in some useful form: his officer is naturally less able to obtain the relevant information if he has no such assistance.

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[1] For a recent case where an anæsthetist was unsuccessfully sued for negligence see the *B.M.J.*, 1942, II. 411.

In inquests into death after anæsthesia, the coroner will probably desire to be informed as to the necessity for the operation (life saving, or prolonging life, or merely æsthetic, or perhaps cosmetic), as to the nature of the anæsthetic, whether the patient was properly examined and prepared and whether there was any difficulty at the giving or taking of it. The medical man giving evidence at such an inquest should realise also that the most important thing is to make it clear to the coroner and to the deceased's relatives that all that possibly could be done for the patient was done.

Nowadays few coroners would have a jury in such a case.

3. If an inquest be held, ought the surgeon also to be involved?

The answer to this question obviously demands an answer to the previous question, "What caused the death of the patient?"—the operation, the anæsthetic, or both together—a question which in some cases is absolutely insoluble. The fact that the surgeon may be implicated in a possible charge of manslaughter shows how serious the position is, and how carefully legislation ought to proceed on the subject. In broad general terms there is again only one defence: "I acted with reasonable skill and care; I explained the nature and risks of the operation to the patient; I got his consent; I got an anæsthetist of known repute to assist me; I did not act in the dual capacity of anæsthetist and operator; and, finally, I was as careful in the operation as possible." All this must be urged, or the absence of one or more factors explained, and the result left to the jury.

4. Should a distinction be drawn between the various general anæsthetics?

The postulates for an absolutely safe anæsthetic and an absolutely safe method of administration have never yet been completely fulfilled, and it is not likely that they ever will be. Whatever method is used to produce anæsthesia there must be a certain risk to the patient, and the choice of an anæsthetic, and whether anæsthesia is to be produced by inhalation, by spinal injection, by injection and inhalation or otherwise are matters which must be left to the discretion of the anæsthetist.

We are of opinion, therefore, that the law should draw no distinction but throw on the anæsthetist the burden of proof.

Patients to whom an anæsthetic may have to be given may be placed in a few simple categories.

A. Those who have consented to have an operation performed upon them for the proper performance of which an anæsthetic is required.

B. Those (children, idiots, etc.) who are incapable of giving a valid consent.

C. Emergency or urgency cases.

In the **first two groups** the necessity of obtaining consent must be insisted on, and the practitioner must first assure himself that an anæsthetic is really necessary. If satisfied on this point there is generally but little difficulty in obtaining the patient's consent to the administration; should he object, the only alternatives are to refuse to do the operation or to do it without an anæsthetic.

Should consent be given, the anæsthetic administered, and the operation performed, there need be no fear about an action for assault on the plea that consent was not given, for it is almost inconceivable that a medical man could by himself administer an anæsthetic and operate without there being abundant collateral evidence of consent; moreover, **the practitioner should never, in any circumstances whatever, administer an anæsthetic without a third party being present.**

A woman once brought an action against a medical man for administering chloroform against her will for the purposes of tooth extraction. The judge defined the claim as consisting of two distinct parts (*a*) an assault, *i.e.* administering chloroform against her will, and (*b*) malpraxis (it was alleged that the extraction was performed unskilfully). She lost her case, there being abundant evidence of consent.

Emergency or urgent cases. It is in this class that difficulties and medico-legal questions of a serious nature may and do arise.

Thus (*a*) the injury may be of such a nature as to demand immediate operation to save life, and be of such urgency that there is no time to obtain consent; or

(*b*) Though not immediately urgent, the necessary delay in getting consent may seriously interfere with the chances of recovery (*e.g.*, in children brought by the police or in the case of urgent symptoms arising after responsible guardians have left the hospital); or

(*c*) The patient may be unconscious or incapable of giving consent through drink or poison, or other cause.

If death occurs in any of the above cases, or, indeed, in any case, there may be criticism:

(*d*) For using any general anæsthetic; or

(*e*) For using the particular one employed;

On question (*a*) the practitioner must satisfy himself that he is taking steps to save a life that would otherwise be lost by delay.

The way out of difficulties (*b*) and (*c*) also lies in the same conscientious consideration of the urgency of an operation to save life. Is the operator reasonably convinced of it? *i.e.*, can he give sound reasons which will convince others of its urgency? If, after weighing all the evidence from all points of view, he is satisfied in his own mind, he should do what is necessary without waiting for consent. Cases of compression of the brain, lacerated or ruptured viscera, burst internal abscess are possible illustrations of the above.

In *Gillies* v. *Cunningham*[1] a widow brought an action for damages against a medical man for the death of her husband, who died under an anæsthetic. The grounds of claim were that the deceased had been given the anæsthetic against his will, and whilst in an unprepared state to inhale it, having partaken of a hearty tea. No other medical man was present. Many practitioners of the highest repute gave evidence in refutation of the allegations, and the widow lost her case.

The following case opens up a wide field of discussion. It is impossible to lay down any special rules for guidance on the subject. Each case must be dealt with on its merits as it arises.

An inquest was held upon the body of a farm hand, who died in hospital on February 6th. Evidence was given that on February 1st the deceased was kicked in the abdomen by a horse. He complained of some pain, but went on with his work for about half an hour, after which he went indoors. On admission into hospital there was no discoloration or abrasion, but there was a slight distension on the right side of the abdomen. By the evening of February 5th the deceased had become very much worse, and an operation had to be performed. The wife was not communicated with in regard to the operation, but she knew of the patient's serious condition. Deceased had agreed to the operation himself. The cook at the hospital, who was deceased's niece, said that she had written to the wife on the evening of February 5th, but she said nothing about an operation. The jury returned a verdict of "Accidental death," and added as a rider, "That in the opinion of the jury the deceased's relatives should have been communicated with before the operation, and that in all serious cases in future the relatives ought to be communicated with." At a meeting of the hospital committee held on February 19th the rider was discussed, and the committee approved of the steps taken by the medical officers and they were convinced that to have delayed the operation in order to communicate with the patient's wife would have been culpable on the part of the medical officers and prejudicial to the patient.

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[1] *Lancet*, 1903, 1, 1067.

Whereas patients and their friends are entitled to give or to withhold consent to an operation, a medical man is clearly under a duty to do his best to save a patient's life.

In *R. v. Hughes* (unreported) a man was brought into the London Hospital late one evening bleeding from a punctured wound in the left forearm. The loss of blood was judged by the house surgeon to be so serious as to necessitate careful examination of the wound under an anæsthetic. During the return to consciousness the patient vomited and choked himself with the contents of his stomach.

At the inquest a verdict of manslaughter against the assailant was returned, and at the subsequent trial the Judge said:

"This case is remarkable in that it goes a step further than any previous case where a wounded man has died from the effects of a necessary operation.

"Here it was not the operation, but the anæsthetic, which accelerated the man's death. Now, had not the man misinformed the anæsthetist as to the time of his last meal, which there is no doubt he did, the anæsthetic would have borne no danger to life.

"Therefore it was the dead man's own mistake that caused his death, and the prisoner could not be held responsible for such a misstatement."

Hughes was found guilty of feloniously wounding with intent to do grievous harm.

A somewhat similar case occurred at the Liverpool Assizes when a man and a woman were charged with the manslaughter of a man with whom the male prisoner was fighting. The blow which caused the death was delivered by the female prisoner. Death was caused in rather a strange way. The female prisoner struck the deceased man on the eye with the neck of a broken bottle. The eyesight was destroyed, and the eyebrow was cut. In the circumstances it was deemed necessary to perform an operation upon the man, and for that purpose an anæsthetic was administered. From his appearance and condition the man seemed to have been a proper subject for an anæsthetic. During the course of the operation, however, he appeared to be in a fainting condition, and he ultimately died from the administration of the anæsthetic in a way which the doctors were unable to account for. The Judge said that in a case of this kind it might be contended with much plausibility that the person who struck the blow in the first instance, and thereby rendered the operation necessary, was liable for the consequences. But it was not desirable in a case of this kind to let the case rest upon such a principle, and therefore if the grand jury found a *prima facie* case against the woman he (his lordship) would have a bill drawn charging her with wounding the man with intent to do grievous bodily harm, leaving his death an open question. The grand jury adopted his lordship's suggestion, and the prisoners were tried for unlawful wounding.

In *Absolom* v. *Statham*[1] an action was brought against a medical man for forcibly administering chloroform to a woman against her will and extracting six of her teeth, also for careless and unskilful treatment, whereby her health was injured. The medical evidence showed that the woman had consented to the operation, and that it had been properly performed; also that her health had sustained no injury by the chloroform or the operation, and that most of her symptoms were due to hysteria. The two charges or complaints were entirely distinct and different, one being for an assault, and the other for malpractice. The law was clear that no surgeon had a right to perform any operation against the will of the patient *so long as the patient preserved consciousness and will.* The law was equally clear that every medical practitioner was bound to bring a reasonable amount of skill and care to the performance of the duty he undertook. The jury found for the medical man on both grounds.

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[1] Unreported.

QUACKERY

Quackery must be considered as a subdivision of malpraxis. Medical evidence is sometimes required when a blatant quack has overstepped his limits ; where, for example, he has signed a death certificate.

The usual way in which the law deals with quacks is by means of a prosecution for obtaining money under the false pretence that they are duly registered medical practitioners. Prosecutions are reported in the medical press from time to time.

The position of " quacks " was well stated by the judge's summing-up to the jury in the *Indian Oculists' Case*,[1] thus :

" If you think these men deliberately performed these operations with the full knowledge that what they were doing was useless, unnecessary, and cruel, as the skilled surgeons tell you, you cannot resist the conclusion that the intention they had was to defraud. If you think that this is not established, then they are entitled to be set free."

As " quacks " they had no ability to raise the presumption that *prima facie* they were skilled and competent. They had to commence their defence *ab initio*. The following are the classes of cases in which a charge of gross negligence has been sustained : Where recklessness, stupidity, or manifest ignorance in an essential matter has been displayed, or where some wilful injury has been effected, *e.g.*, by way of experimentation, or by treatment otherwise than for the patient's benefit, or by treatment when the practitioner was not in a sober condition. It has been established that one may not experiment on a patient, or, rather, that one experiments at one's peril.

Quackery does comparatively little harm so long as adults consult quacks of their own free will; but the matter becomes much more serious when helpless children are consigned to the care of faith-healers and others. The law seems utterly powerless to check this practice.[2]

CHRISTIAN SCIENCE

Christian Science is a cult founded by a Mrs. Eddy in 1883 which has a great number of adherents. It is a religion as well as a medical cult. Christian scientists do not believe in the existence in fact of pain or sickness and consider that only the belief in pain really exists. They therefore treat all maladies as phenomena curable by faith. They do not believe in the action of drugs or in the tenets of orthodox medicine.

There have been many cases where persons have died owing to refusal to obtain medical advice or treatment, and so far as any individual is concerned it is his own affair whether he obtains treatment or not. The case is otherwise when a person responsible for the health of another refuses to obtain medical treatment and when death results owing to the lack of such treatment. In these cases the parent or guardian may be prosecuted for neglect, but the fact that a patient died, not as a

[1] 1893. (unreported).

[2] *Vide B.M.J.*, 1903, 2, p. 1185, where a man was fined 20*l* for unlawfully and wilfully neglecting his child of five years of age by trusting to faith-healing ; and see cases mentioned below under " Neglect by Parents."

result of something which the Christian Science practitioner did, but as a consequence of something which he did not do, makes it difficult to prove a charge of manslaughter or culpable homicide.

In England, the followers of Mrs. Eddy have long exercised a wise discretion in the matter of procuring for the children under their control that medical aid with which they must themselves dispense if they would faithfully obey the precepts of their prophetess. They have, in short, been aware that to neglect to procure medical aid for a child might involve them in a serious criminal charge, and they have accordingly obtained it. In Canada they will now presumably follow the same course, for the Court of Appeal of Ontario has held in the case of a " Christian Scientist " that medical aid is a " necessary " within the meaning of a section of the Criminal Code which makes a parent liable for omitting to provide necessaries for a child under sixteen years, and that where death follows the omission the parent may be convicted of manslaughter. In England, under the Poor Law Amendment Act, 1868, it used to be an offence for any person " wilfully to nglect to provide adequate food, clothes, medical aid or lodging " for his child, whereby the child should be, or should be likely to be, seriously injured. This section, which apparently contained an attempt to define the " necessaries " referred to in the Canadian Code, is now repealed, and under the Prevention of Cruelty to Children Act, 1894, any person having the custody or care of any child is guilty of a misdemeanour if he or she " wilfully neglects such child in a manner likely to cause such child unnecessary suffering or injury to its health." The omission of any direct reference to medical aid in the later Act rendered it necessary to have recourse to the Court for Crown Cases Reserved in a faith-healing case where death had resulted. In that case[1] Lord Russell of Killowen, L.C.J., pointed out that " it would be an odd result if we were obliged to come to the conclusion that in dealing with such a subject as the protection of children the law had meant to take what may be described as a retrograde step " ; and the court unanimously upheld the conviction for manslaughter. In the case before the Court of Appeal of Ontario the indictment was under a section of the Criminal Code of Canada (Statutes of Canada, 55 & 56 Vict. c. 29, s. 210, sub-s. (i)), which is as follows : " Every one who as a parent, guardian, or head of a family, is under a legal duty to provide necessaries for any child under the age of sixteen years, is criminally responsible for omitting, without lawful excuse, to do so while such a child remains a member of his or her household, whether such child is helpless or not, if the death of such child is caused or if his life is endangered or his health is or is likely to be permanently injured by such omission." The questions raised upon this were whether the term " necessaries " included medical treatment and whether the Chief Justice of the King's Bench Division of Ontario, the Hon. Glenholme Falconbridge, who tried the case, had rightly directed the jury that the evidence of witnesses that they had been cured or benefited by " Christian science " treatment had no bearing on the case except as showing the good faith of the prisoner. In deciding the first in the affirmative the Hon. Charles Moss, Chief Justice of the Court of Appeal, Ontario, laid down that " what is included in necessaries is to be determined upon the circumstances of each case, and whether there has been neglect to supply them must also depend upon the circumstances." This would protect the parent who, believing his child's case to be of a trifling nature, did not consider medical aid to be necessary, although, in fact, it was necessary, and would leave the jury the question whether in all the circumstances of the case " medical assistance and treatment were necessaries proper to be provided for the child, having regard to the state and condition in which the evidence showed him to be." With regard to the evidence of " Christian science cures," the learned Chief Justice held that they were properly excluded from the jury's consideration upon the main issue as to whether necessaries had been provided or not, and that as the good faith of the prisoner was not in question the evidence could not have been received at all. This eminently sensible and satisfactory decision should result in the saving of an appreciable number of children from death or injury to their health at the hands of " Christian scientists " and other absurd but dangerous people, although the section of the Code which it interprets does not go so far as the British Act, which makes penal the causing of " unnecessary suffering." Both the decision in

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[1] *R.* v. *Senior*, [1899] 1 Q. B. 283

R. v. *Lewis*, the case before the Court of Ontario, and that in *R.* v. *Senior*, referred to above, are, however, no more than we were entitled to expect. A serious slur would be cast upon medical science in the present day if our law courts refused to recognise its aid as necessary in cases of serious illness or injury where relief is desired, or denied its power to alleviate suffering.[1]

Statutory recognition is now given to "Christian Science" in England, for by the Public Health Act, 1936, the Minister of Health is empowered to grant exemption from the operation of the Act in respect of any nursing home which is or will be carried on in accordance with the practice and principles of the body known as "the Church of Christ Scientist."

NEGLECT BY PARENTS AND OTHERS

The law as to the responsibility of persons through whose neglect death takes place was clearly stated in *R.* v. *Charlotte Smith*,[2] where the accused was indicted for having caused the death of her servant by having neglected to supply her with proper food and lodging. The judge said that if a person has the custody and charge of another, and neglects to supply proper food and lodging, such person is responsible if death results from such neglect. In such cases there must be a duty arising from the helpless condition, such as illness, immaturity or insanity of the person who is under control.

In this connection, see *R.* v. *Chattaway.*[3]

In *R.* v. *Morby*,[4] where the accused's son died of small-pox, it appeared that the accused was a member of a religious sect which did not believe in medical aid, and that, therefore, he had not obtained any medical advice or attendance. It was proved that medical assistance might have saved the child's life, and would have increased its chances of recovery; but, inasmuch as there was no conclusive evidence that death was caused or accelerated by the neglect to provide medical aid, the accused was acquitted of manslaughter.

In this connection, see *R.* v. *Senior* (*supra.*)

The Children and Young Persons Act, 1933, facilitates prosecution for neglect in cases where a parent or other person having charge of children fails to provide medical aid.[5]

In 1909 a man and his wife, members of the "Peculiar People" sect, were sentenced to three months' hard labour for neglecting to provide proper medical aid for their child, *æt.* 4. In 1935 a man and his wife were convicted under the Children and Young Persons Act, 1933, of failing to provide adequate medical aid to a child in their custody, who on medical evidence had died because of its parents' neglect to provide medical aid. The parents were members of the "Peculiar People" sect.

Herbalists, Bonesetters, Chiropractors, Osteopaths, and other unregistered practitioners may practise their particular cult without hindrance, within the limits mentioned in this chapter, provided they do not pretend to be registered medical practitioners.

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[1] *Lancet*, 1903, II, p 1946.
[2] (1865), L. & C. 607
[3] (1922), 17 Cr. App. 7.
[4] (1881), 8 Q. B. D. 571.
[5] For a case brought under this Act see *B.M.J.* (1941) II. 832.

The position of **herbalists**, so far as regards criminal responsibility, was stated by the Court of Criminal Appeal in *R.* v. *Burdee.*[1] In that case the accused (a violinist) was interested in herbalism and fasting as a cure for rheumatism; and in April, 1916, he commenced giving advice, for which he charged fees. In July, 1916, he gave advice to a confirmed invalid, and the patient died soon after she had abstained from food, in accordance with the accused's advice. There was medical evidence that death was caused by heart failure, due to disease of the heart, but accelerated by lack of food. The accused was convicted of manslaughter.

In giving the judgment of the court, Darling, J., said: "If any person, whether he be a regular or licensed medical man or not, professes to deal with the life or health of His Majesty's subjects, he is bound to have competent skill to perform the task that he holds himself out to perform, and he is bound to treat his patients with care, attention and assiduity."

Advertisements by herbalists and other unregistered persons relating to (*a*) articles to be used for the treatment of Bright's disease, cataract, diabetes, epilepsy or fits, glaucoma, locomotor ataxy, paralysis, or tuberculosis, and (*b*) articles to be used for procuring the miscarriage of women are prohibited (with certain technical exceptions) by the Pharmacy and Medicines Act, 1941. The Cancer Act, 1939, contains similar provisions relating to cancer.

The legal position of osteopaths was considered in *Hall* v. *Trotter.*[2] A paper on "Osteopathy and its Medico-legal Aspect" was read before the Medico-Legal Society on 17th June, 1924.[3]

In *R.* v. *Ensor* (1932) the Recorder of London said that the medical profession had no monopoly of the healing art. He said that osteopaths and others had professed the healing art in various directions, with "a perfect right to treat patients every bit as much as any qualified doctor, so long as the public knew with whom they were dealing." In 1932 and 1933 several osteopaths were fined for describing themselves as "osteopathic physicians and surgeons" or as "manipulative physicians and surgeons" contrary to the Medical Act, 1858. There seems to be no legal objection to osteopaths describing themselves as "doctors," provided they do not pretend to be registered medical practitioners.

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[1] (1917), 86 L. J. K. B. 871.

[2] (1921), 38 T L. R. 30, where the High Court held that the Medical Act, 1858, s. 32, does not apply to manipulative treatment such as services rendered by an osteopath who does not advise and prescribe. See also *Macnaghten* v. *Douglas*, (1927) W. N. 156

[3] See "Medico-Legal Transactions," 1923–24.

CHAPTER IV

IDENTITY

IDENTIFICATION OF LIVING PERSONS AND HUMAN REMAINS

The necessity for the identification of individuals is a matter of every-day occurrence throughout our criminal and other courts, and probably cases of mistaken identity are numerous, but none has been so notorious as that of Adolf Beck in 1903–4, in which it was fully recognised that a mistake was made. An account of the legal difficulties in the case is given in a leader in *The Times* newspaper for August 19th, 1904. The points relied upon for identity seem to have consisted chiefly in the general likeness of hair on the face, similarity of features, etc., so far as the common witnesses were concerned. On the scientific side identity of handwriting was the chief point relied upon. On the medical side the principal fact was that Beck had not been circumcised, and was therefore not a Jew. It is on the legal side, however, that the principal interest of the case centres, for the medical evidence (as also a perfect *alibi*) seems to have been ignored or ruled out of court. The fact remains that an innocent man suffered penal servitude through mistaken identity, and that this arose not from *medico*-legal defects, but through legal technicalities and police obstinacy, and need not, therefore, be given in detail here.

The factors to be considered in connection with identification and the questions that may arise in connection therewith are very numerous. Some can be answered only by a medical man, some lie more in the province of a detective, while others can be attested by any observant witness. Most of these points have other important connections in legal medicine, but there is no link other than identity which connects them, and they will therefore be considered once for all in this connection.

Identification may be required of—

(A) A living person or one recently dead.
(B) Mutilated or fragmentary remains.
(C) Bones only.

The means available for identification are as follows :—

Mental power. Memory. Education. Speech. Gait. Mannerisms Handwriting.	These can obviously be used only in relation to a person actually living at the time of inquiry.

Complexion.
Likeness of features.
Occupation marks.
Clothes, jewellery and articles in pockets.
Race.
Deformities, birth marks, peculiarities of nails, etc.
Injuries leaving permanent results.
Anthropometry (Bertillon's system of identification).
Dactylography (the finger-print system of identification).
Stature, weight.
Teeth.
Scars and tattoo marks.
Sex.
Hair.
Age.

Of these some can be used in the living or the very recently dead, others in those dead for a longer time. Many of these points have interest other than that of mere identification; they will be discussed here once for all so as to avoid repetition.

In Class B.

See p. 140.

In Class C.

See p. 148.

Before mentioning any details, attention must be drawn to a principle of probabilities in logic or evidence; it is the **law of multiplicity of evidence**, and may be thus stated :—Supposing one witness or fact testifies to a certain thing, or points to a certain conclusion, then if a second *independent* witness or fact testifies in the same direction the probability of the conclusion being correct is more than doubled; and if a third *independent* person or piece of evidence corroborates the first two, the probability of the conclusion being correct has a yet still higher multiplying factor, and in ordinary cases may be accepted as a certainty. This principle has a wide field of application in all medico-legal questions.

Mental Power Memory, and Education

These three points are essentially ones that require no detailed discussion for they come within the province of the ordinary intelligent witness. They assumed a very high degree of importance in the cross-examination of the claimant to the Tichborne estates in 1872 and 1873 (the case, which occupied the court for some weeks. offered some distinctly good medical points; see p. 107). The intention of counsel was to show that the claimant was a man of poor mental power, inferior memory, and slight education. while the real Roger Tichborne was a man of good mental capacity, fair memory, and well educated.

Speech

Stammering, stuttering, and lisping are the most obvious peculiarities, and may under certain circumstances, as when people are heard quarrelling or in excited conversation, become of importance in identification. To recognise a person by the voice alone would be a risky proceeding in a criminal charge, though it is often enough accepted upon less important occasions. A question might be asked of a medical man whether a stutter for which there was no organic cause was curable. To this an unhesitating reply in the affirmative must be given. He might also be asked whether an operation could cure a case for which there was some deformity of the mouth to account. To this a more cautious reply must be given, according to the nature of the organic defect : a cleft palate, for instance, can most likely be remedied by operation ; but much would depend upon the age of the patient in answering the question, " How far would the voice alter and improve if the operation were successful ? " In a case where damages were claimed by someone whose living depended upon the voice, it is possible that a great difference of medical opinion might arise. No general rule can be laid down upon the subject ; each case must be judged upon its own merits. The *timbre* of a voice, which constitutes the means by which we, unconsciously perhaps, judge voices, depends very largely on the number and character of the overtones, and these may easily be altered by disease or accident.

There are certain kinds of speech dependent upon nerve diseases, *e.g.*, disseminated sclerosis, or general paralysis of the insane, upon which a medical opinion might be asked in a court of law, but they belong too much to the domain of general medicine to require further notice here. We must note how false teeth may alter a voice.

Gait and Mannerisms

We are constantly in the habit of recognising friends and acquaintances by the character of their gait and from certain mannerisms. Lameness or other disability in walking might require a medical examination to elucidate its cause, especially if malingering were suspected. Ways of sitting, leaning, moving the hands, movements of the body, shrugging of the shoulders, movements of the facial muscles, brows, etc., are often characteristic and difficult to disguise for any length of time.

Handwriting

The study of handwriting can scarcely be considered one of the branches of medical jurisprudence.

It is essential, however, that the medical jurist should have a certain knowledge of the scope of this subject, so that he may not fall into the common error of assuming that all handwriting experts are unreliable. The trouble arises from the fact that a number of people who study merely the superficial characters of writing are quite prepared to give an expert opinion as to the authenticity or otherwise of a document, and, as a general rule, the less the knowledge of such persons the more didactic they become in their statements.

In the examination of documents to ascertain whether two samples of writing are by the same hand, the documents must be patiently searched for certain peculiarities in the formation of letters, the manner in which the upstrokes and downstrokes are formed, characteristic methods of joining certain letters together, and so on. These peculiarities are then searched for in the second sample, and if the two are by the same hand it is practically certain that a number of the same peculiarities and characteristic forms will be found. Of course, these must be in sufficient number and sufficiently out of the ordinary to exclude the possibility of a chance relationship. The greater the number of words to be compared, the greater the chance of the expert to detect similarities, and where there are only a few words written it is often impossible to give any decision.

The subject has become of great importance since the examination of documents, ink, etc., has passed into the hands of those qualified to examine them, and, though the science can never attain the state of certainty of finger-print identification, it has great possibilities, and genuine experts should be made more use of by the authorities.

Those interested in the subject will find ample information in the two following manuals: "Questioned Documents" (Albert S. Osborn, 1910); "Manuel de Technique Policière" (Locard, 1923); in the latter of which there is a full bibliography.

Complexion

This is an obvious consideration in the living and in the recently dead. The differences between the extremes of brunette and blonde are marked enough, but all such points as pale, florid, sallow, etc., disappear or alter soon after death. Organic changes in the skin, such as freckles, pimples, etc., are more enduring, and are likely to be recognisable for some little time after death, provided decomposition has not advanced very far. In judging the colour of the complexion it is most important that the individual, alive or dead, be examined by ordinary daylight, for in the usual forms of artificial light, with a large preponderance of yellow rays, the finer shades of skin colour are quite indistinguishable, and even deep jaundice cannot be appreciated without great difficulty.

Likeness of Features

During life the general expression of the face can be so readily altered by voluntary power that mistakes can easily be made. The notorious Charles Peace, who was executed in 1879, was so clever at disguising his features by voluntary movements that he was frequently able to converse without discovery with detectives who knew him. After death such voluntary alteration is, of course, impossible ; but death so speedily alters expression that too much reliance must not be placed upon this mode of identification. Photography again is notoriously an unreliable method of identification unless minute details are considered.

The details of features are more enduring and more satisfactory as evidence of identity. The colour of the irides, possibly different in the two eyes, or with peculiar segments in them, the size of the ears and their lobes, the length of the nose, the shape of the chin, lend themselves to exact observation and measurement, as in the Bertillon system, and may lead to definite results in identification. An artist or draughtsman is, however, much better qualified than a medical man to speak to such details. Hence in bastardy cases a medical witness must be cautious in drawing deductions from an alleged likeness between the child and the putative father. *Vide* the Slingsby case, 1916.

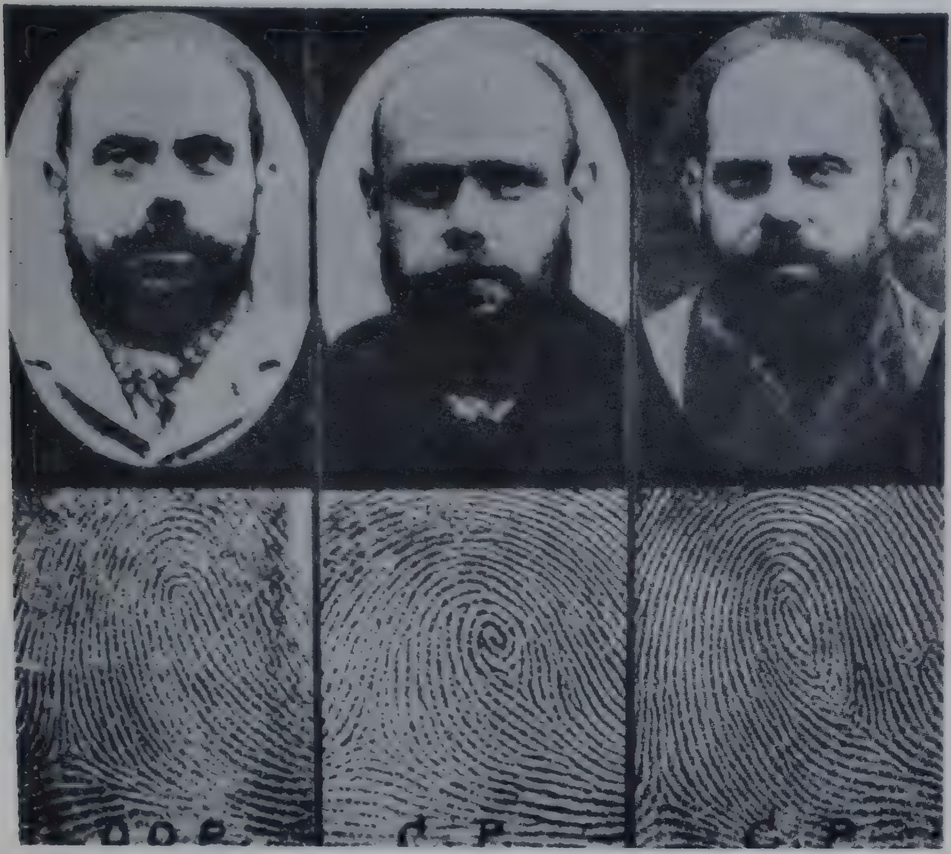


Fig. 1.—The photographs of three different individuals who closely resemble each other. The right thumb-prints shown under the respective photographs are quite distinct. Two of these persons were so alike that when one was arrested he had to be identified and named from his finger-prints by the Scotland Yard authorities.

The identification of persons by sight alone leads to endless mistakes in ordinary life without any particular inconvenience, but such mistakes occasionally occur in connection with criminal identification with possibly serious results. It is common experience that the average truthful witness is absolutely unreliable in the majority of cases when asked to identify a certain individual whom he is supposed to have seen. Nearly every person has others who are more or less like him, and occasionally this resemblance is so startling that it is impossible to recognise the difference between the two people when seen apart. A good example of such resemblance is seen in Fig. 1, in which three different men who have come under the notice of Scotland Yard are shown together.

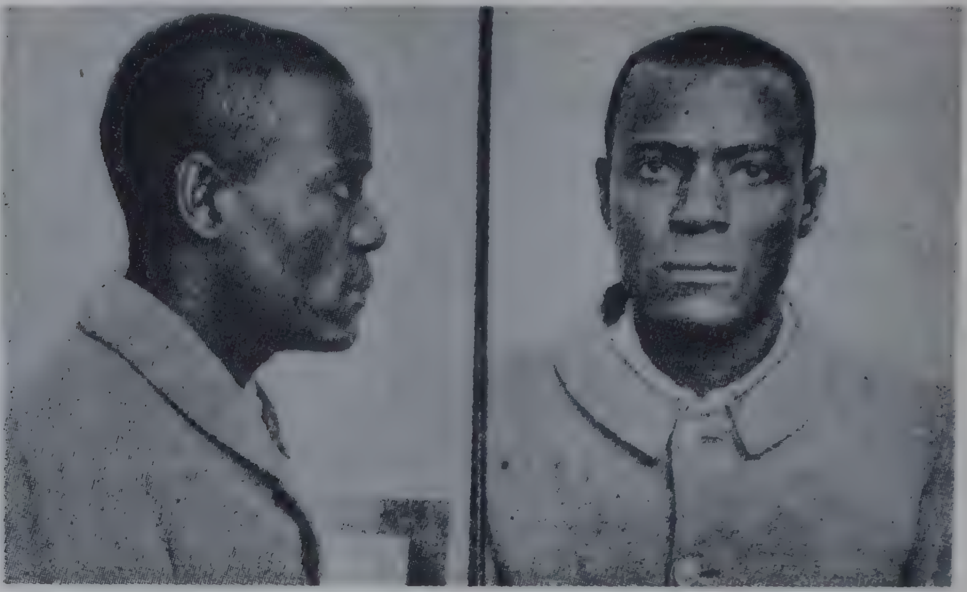


Fig. 2—Photograph of Will West, No. 3426, of the U.S. Penitentiary at Leavenworth. (*After Wilder and Wentworth, "Personal Identification," p.* 31.)

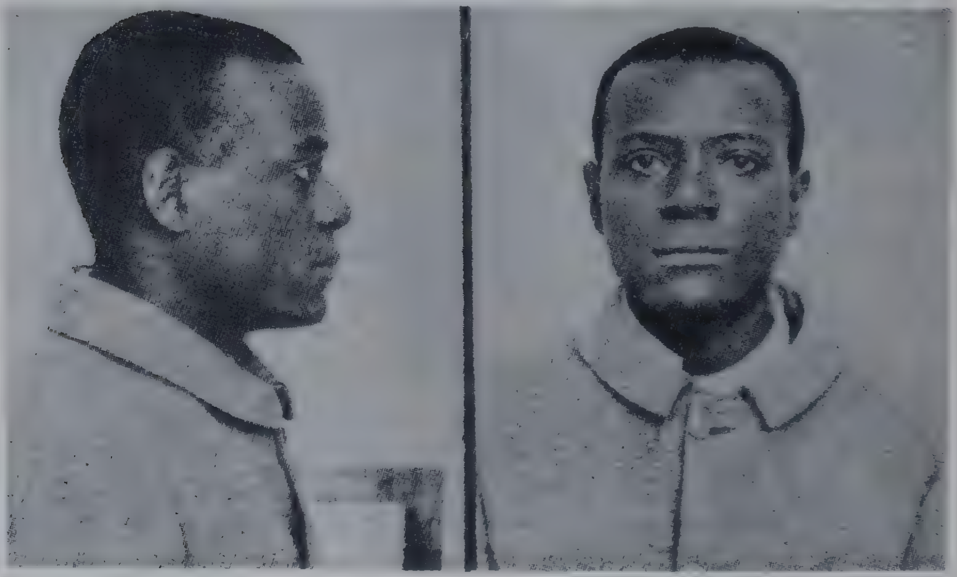


Fig. 3.—Photograph of William West, No. 2646, of the same Penitentiary. These two men were in prison at the same time. (*After Wild and Wentworth, " Personal Identification, p.* 31.)

The most remarkable case of resemblance, however, is that of two men (Figs. 2 and 3) who were in the same prison at the same time, bore the same name, and had practically the same Bertillon measurements.

Their finger-prints, however, were absolutely different, as will be readily noticed (Fig. 4).

These examples serve to show the great danger of sight recognition in criminal identification.

In other instances the same individual is completely changed by modifications in the method of trimming the moustache or beard, or by shaving it, as is seen in Fig. 5.

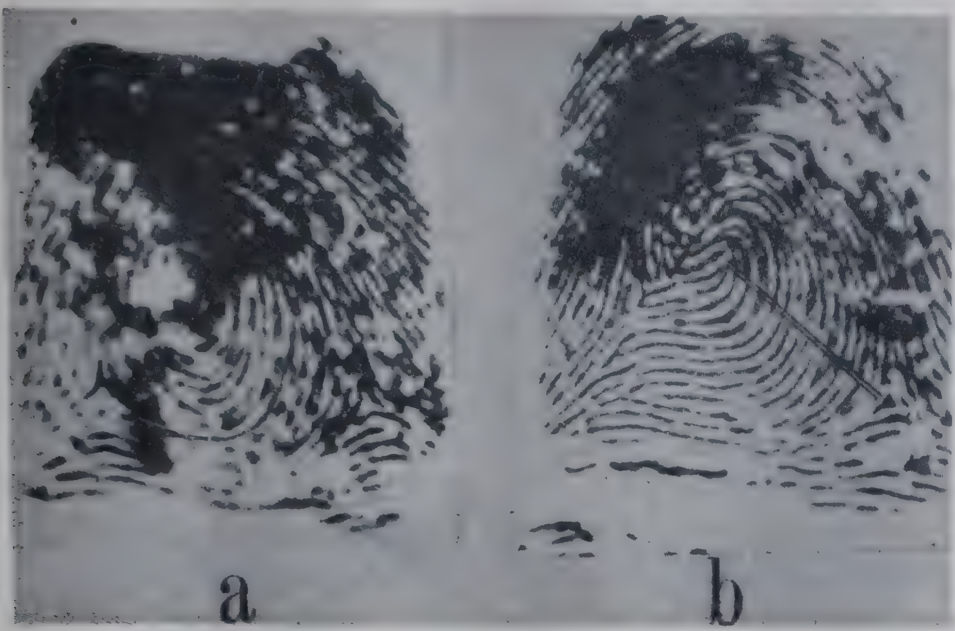


FIG. 4.—The prints of the left index fingers of the two persons shown in Figs. 2 and 3.
(*After Wilder and Wentworth, "Personal Identification."*)

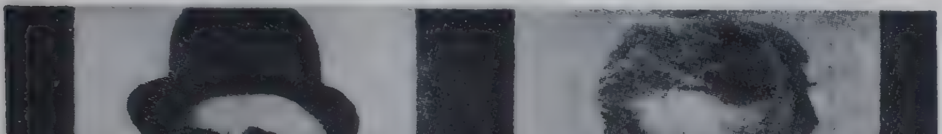


FIG. 5—Two photographs of the same person. The first was taken in November, 1908, and the second in December, 1909.
(*After Wilder and Wentworth, "Personal Identification."*)

Occupation Marks

These are of two classes: (*a*) stains, etc., of recent occupation, such as spots of paint on painters and decorators, dye in dye workers, grease in engineers and mechanics, dust of flour in bakers and millers, and so on.

In the absence of stains or marks on the clothes, evidence of occupation and habits may be found in the dust and *débris* in the pockets, under the finger nails, and in the cerumen in the ears. Microscopic examination of dust and *débris* is of prime importance as an aid in the identification of unknown bodies.

Apart from the above, evidence of the social status, habits, etc., of the person may be obtained from the general condition and state of the clothing, its obvious value, cut and finish. The cleanliness of the clothing and skin and the care which has been taken with the nails, teeth, hair, etc., may be points of value.

(*b*) More permanent organic changes, which may receive brief notice here. They are, generally speaking, of more value when the body of an unknown person is found under suspicious circumstances than in questions connected with living persons, though in the latter they may afford useful evidence corroborative or otherwise of the tale of a prisoner. The horny-handed son of toil can be thus easily distinguished from one who has not performed much manual labour ; the callosities on a bricklayer's thumb, those on a harpist's fingers, are examples of more particular trades ; the depressed lower end of the sternum in boot-lasters may also be instanced, as well as bursæ on the outer malleoli of tailors. In modern tradesmen there is less tendency to the formation of trade-marks or deformities, but if an unknown body is being examined, all marks resulting from occupation should be described and photographed.

Clothes, Jewellery, and Articles in the Pockets

These may not always be of much value, inasmuch as they may be manufactured in large quantities of such identical nature as to defy individual recognition, but they may be of the highest importance in the identification of an unknown body and should be preserved with the greatest care. The name of the tailor or maker on the tags or buttons of the clothes, the presence of laundry marks, dyers' marks or repairs, should be recorded at once. Watches frequently have private marks inside the cases made by the watchmakers who have carried out repairs.

In the summer of 1903 Miss Fanny Hickman, a woman physician, disappeared. Some two months later a body was found in Richmond Park very much decomposed. The medical evidence on her case will be found in full under the heading of "Decomposition." In the present connection the interest in the case lies in the fact that the strongest items in identification were her clothes, a watch and chain, and two bronze medals, one of which, at least, had her name upon it. These were all positively sworn to by her maid.

Race

This is a method of identification which is not infrequently of use in seaport towns. The hair (*vide* under "Hair") ; the skin, black in the Negro and some other races, dark brown in Indians and some other aboriginal races, yellow in Mongolians ; the lips, varying in thickness and shape, are all useful for identification if decomposition has not proceeded too far. If bones alone are found, racial identification is extremely difficult and should not be attempted by the ordinary practitioner. The help of a skilled anthropologist should be obtained in all cases.

Deformities and Birth-marks

These are most important, and must be very carefully noted in the external examination of a dead body as well as in describing the person of a living individual. Moles, nævi, port wine stains, are all distinctive marks, easily seen on babies and young children, noted and remembered by nurses and mothers, and frequently (*e.g.*, in Arthur Orton's case) used as means of identification in later years, when prolonged periods of separation have altered the features of a child's face beyond recognition. Here we get an excellent illustration of the principle of multiplicity of evidence enunciated above. Thus one small birth-mark of any particular shape, say on arm or face, is common enough, but to get two of particular shapes on particular parts of the body agreeing with known marks on an individual is very rare, and if it were found that a corpse or living individual possessed three such peculiar marks, it would be a practical certainty that it or he was the actual individual who was previously known to have three such peculiar marks. Club-foot, harelip, cleft palate, congenital absence of limbs or parts of them, permanently split nails, congenital dislocations, etc., etc., are further illustrations of deformities which are of value in identification.

A case is reported by Beck in which a girl, Salomé Muller, had been sold as a slave, but her identity as the child of German parents was proved after fifteen years by two marks resembling moles, about the size of coffee-grains, on the inside of the thighs. They were proved to have existed in the child, and to exist in the same parts of the body of the girl eighteen years afterwards. After much litigation she was, upon this evidence, pronounced to be a free woman.

Injuries leaving Permanent Results

Scars and tattoo marks (*vide* below) really come under this head, and so do ununited or badly united fractures of bones. Surgical amputations and operations on joints form, perhaps, the best remaining illustration ; but these are so common that, standing alone, they would be of small value. Associated with other points, they might acquire increased importance. The history of their occurrence might be very useful as corroborative evidence.

In the trial of Crippen for the murder of Belle Elmore the presence of a scar on a piece of abdominal skin was an important factor in the identification of the remains as those of the missing woman.

Anthropometry

Bertillon's System of Identification

Before 1882 identification and registration of convicted persons depended entirely on description and photographs of the individual, but at that date Bertillon brought forward a new system under which the description of appearance and bodily peculiarities was replaced by definite measurements of certain parts of the body. It was adopted by the French Government, and was a great advance in scientific identification.

The system depended on the registration of the characteristics of an individual under the following heads :—

(A) Descriptive data, such as colour of hair, eyes, complexion, shape of nose, ears, etc.

(B) Body marks, such as moles, scars, tattoo marks.

(C) Body measurements, of which there were eleven, as follows :—

(1) Standing height.
(2) Arm reach.
(3) Sitting height.
(4) Length of head.
(5) Breadth of head.
(6) Length of right ear.
(7) Cheek breadth.
(8) Length of left foot.
(9) Length of left middle finger.
(10) Length of left little finger.
(11) Length of left forearm and hand (to tip of middle finger).

These details were placed on a card together with a profile and full-face photograph.

The method was of great value in the identification of criminals, but it required considerable apparatus, while the personal factor in measurement introduced errors which in certain cases were greater than the difference between individuals, and therefore absolute identification was not possible.

Dactylography

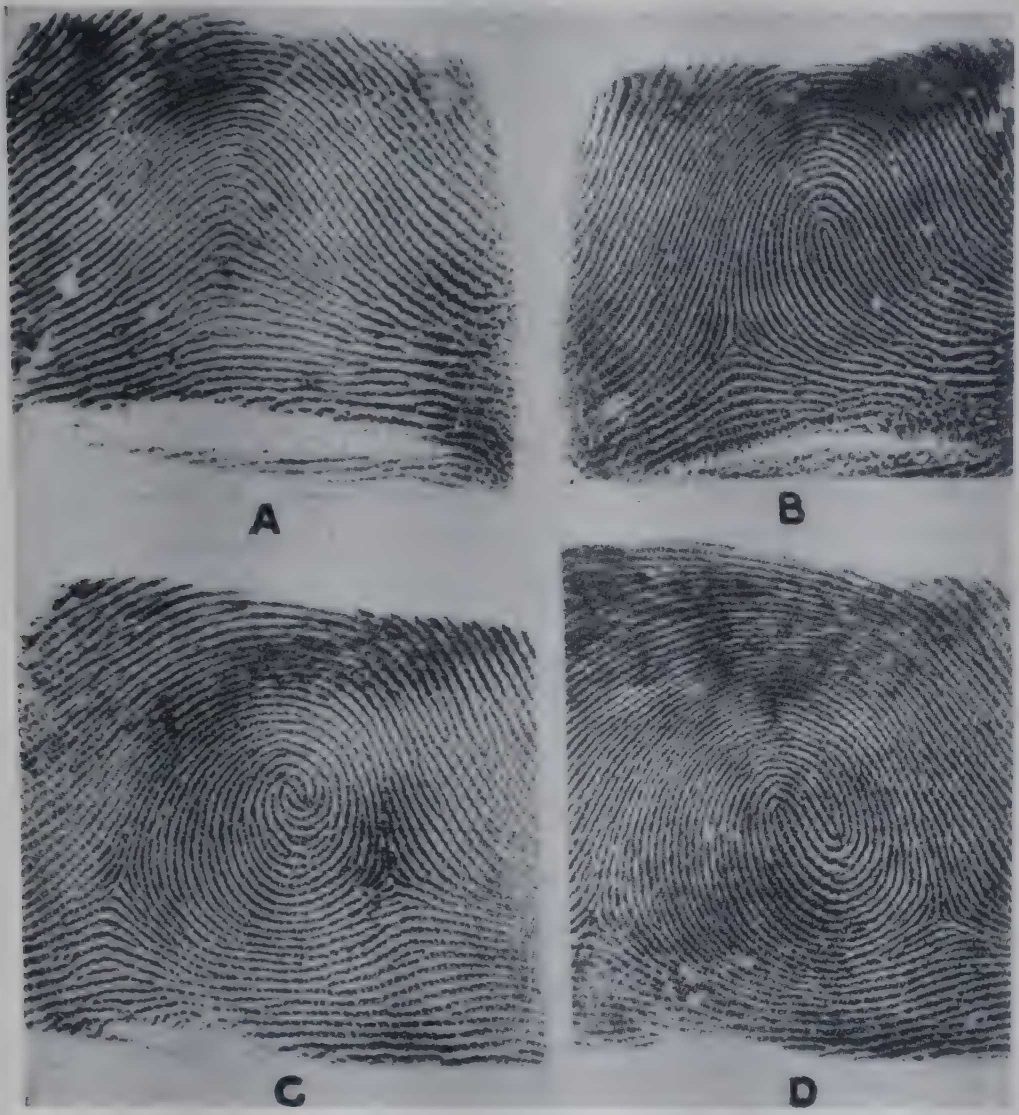
The Finger-print Method of Identification

In 1894 the method of identification by finger-prints was officially introduced into England, and is without doubt the only absolute and infallible method of identification.

This system depends upon the fact that the skin on the terminal phalanx of each finger is covered with ridges which form definite curved patterns. These remain constant in any individual from birth to death, and even the most minute structures and details are never the same on any two fingers; that is to say, that finger-prints are absolutely individual and are unchanged by time.

Although it is only the terminal phalanges on which patterns are found, skin ridges may be seen over the whole surface of the palms and soles, but on no other part of the body.

The honour of first proposing this method, which has revolutionised personal identification, must be divided between two Englishmen: Dr. Henry Faulds and Sir William Herschel. Faulds first publicly described the method in a letter to *Nature*, published on October 28th, 1880, and there can be no doubt that at that time he was fully aware of the importance of taking prints of the ten fingers in identification, and he also discussed the possibility of identification of chance impressions and of mutilated parts.



[*From "Forensic Medicine," by S. Smith.*

FIG. 6.—FINGER-PRINTS.

A. Arch. B. Loop.
C. Whorl. D. Composite.

Herschel followed this by a letter in the same journal in November of the same year, in which he stated that he had been using the method described by Faulds for about twenty years, and it appears that Herschel submitted a report in 1877 asking to be allowed to use the system as a means of identifying prisoners.

The actual founder of the present system of identification by finger-prints is Sir Francis Galton, for he not only proved the individuality and permanence of such prints, but devised a scheme of classification which enabled a particular print to be at once selected from however large a collection. The system so devised was further improved and simplified by Sir Edward Henry, of New Scotland Yard, London, and is to-day in use over practically the whole world.

In practice finger-prints are taken by pressing the ball on the tip of each finger of each hand separately on a surface inked with printer's ink, then pressing the finger on glazed paper with a slight rolling movement to obtain the whole anterior surface.

If such prints are examined, it will be found that the ridges on the finger-tips have left a series of curved lines. These resolve themselves into well-defined patterns which are described for the purposes of classification as loops, arches, whorls and composites, the latter class containing all those forms which cannot be placed accurately in any of the other three classes. The characters of these patterns are well shown in Fig. 6. Prints are classified according to the different patterns present, the loops, which are by far the most frequent kind of pattern, being divided into ulnar and radial loops according to the side on which they open. The ulnar loop, which is present in about 60 per cent. of finger-prints, is again subdivided according to the number of ridges which lie between the delta and the core.

Apart from the individuality of the ridge patterns, it will be found on suitable magnification that each line has definite individual features. Thus a ridge may break or form a fork, or an isolated island may be enclosed by the division of adjacent ridges. These details are of the utmost importance, and as they are unchanging in their character and never duplicated in different hands, they offer a means of identification where there are only fragments of skin to compare.

Locard has gone much further with this part of the subject and describes a method of identification by the examination of the pores of the skin which open on the ridges. These pores are always the same in a given subject, and are not modified by age or use. They differ from one another in position, size, form, the number in a given length of ridge, and in the way in which they open in the middle, or on one or other side of the ridge. Of course the number and variety of these pores prevent any possibility of indexing or cataloguing, and therefore they could not possibly become the basis of any system of classification, but if it is possible to obtain two prints for direct comparison, they are of very definite value, especially when the chance impression consists of a bit of skin without definite patterns.

Identification by finger-prints is of value in many distinct ways, but particularly in the identification of a person who denies his identity and whose finger-prints previously taken are at hand for comparison, and for the purpose of identification of a known criminal whose finger-prints have been accidentally left at the scene of a crime.

It is only occasionally that good prints are left accidentally, and only when the person has touched smooth articles. Prints on plain wood and other unpolished surfaces are usually of no value.

In many instances a surface which on superficial examination appears to be free from finger-prints may be shown to have quite excellent prints by suitable treatment.

It is sometimes possible to bring out such latent prints by photography under proper light conditions, but it is often necessary to develop them first. The surface which has been in contact with the finger receives traces of perspiration which accurately mark out the ridges on which the pores open. If fine powder is dusted over these impressions before they become quite dry and the excess powder dusted off, enough is left adherent to the moistened lines to enable these to be photographed. If the lines are on paper or light surfaces they may be brought out by powdered graphite or antimony ; if on glass or dark surfaces the ordinary grey powder (Hydrarg. c. Creta) may be used. Locard uses red oxide of lead and finds it most successful. The powder should be very gently dusted on with a camel's-hair pencil, and the process of removing the excess must be done with care, or otherwise the details of the ridges may be obliterated. Occasionally when prints are on glasses or bottles they may be made suitable for photography by filling the bottle with a dark fluid.

Latent prints on paper, such as on anonymous letters, which are not brought out by dusting with graphite, may be developed by exposing the paper to the fumes of iodine or bromine ; the prints developed by this method are fugitive, and must be photographed at once. They may be shown by moistening the surface of the paper with coloured fluid, such as weak eosin, but this is rather messy, and seldom produces a good print. Nicefero[1] recommends brushing the paper over with 8 per cent. solution of silver nitrate, and then exposing it to sunlight. This develops certain prints, but turns the paper almost black.

We find that prints may be developed by treating the suspected paper with a 1 per cent. solution of nitrate of silver and allowing it to dry in a dark room. The paper is then developed with metol-quinol developer, washed and fixed in hyposulphate solution, exactly as if gas-light paper were being treated. The result is a clear black or brown print with only slight staining of the rest of the paper. We have also tried the effect of Sudan III., scarlet red and osmic acid, which might be expected to stain fatty substances in the print, but find them inferior to the silver method outlined above. Space prevents further details of this subject, but those interested may obtain full details of the classification and other interesting matters from the following manuals: Faulds' "Dactylography"; Herschel, "The Origin of Finger Printing"; Galton, "Finger-prints"; Henry, "Classification and Uses of Finger-prints"; Wilder and Wentworth, "Personal Identification."

Stature and Weight in Identification

If it were not that the obvious is so often overlooked, one would say that in the living or recently dead these two points were too obvious to require mention.

Exact observations of both should invariably be made and recorded.

In works on physiology, when the subject of growth is under discussion, tables of increase of length and weight according to the age are commonly inserted, but they have very little medico-legal interest, for they deal only with averages, and it is common knowledge that wide exceptions are very frequent. When evidence is required from a witness regarding a person whom he had known some time before, no reliance can be placed upon his suggestions as to what his expectation of height and weight would be.

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[1] "La Police et l'Enquête Judiciaire."

The subject of stature in connection with fragments of a body, and with bones, possesses, however, very great interest, and will be found fully discussed under " Identity of Bones " (p. 148).

Teeth

The teeth, under natural conditions of decomposition, are practically indestructible. They therefore offer over an almost unlimited time an excellent means of identification. In infancy and childhood they are fairly regular in their development and appearance, and thus afford a very useful criterion for the estimation of age in young subjects. We must discuss the teeth from both points of view.

A. THE TEETH AS A MEANS OF IDENTITY

In any case in which identity may possibly come into dispute, observations on the jaws must be most carefully made and recorded. We may enumerate the following points :—

(*a*) The number of teeth present.

(*b*) The number lost, including any evidence of how long lost.

(*c*) The nature, *i.e.*, the names as ordinarily applied. of those left and those which have disappeared, and whether temporary or permanent.

(*d*) Any peculiarities in their arrangement, *e.g.*, prominent or the reverse, crooked or straight, crowded out of place or not.

(*e*) The condition of those left, whether much worn or not, and their colour and cleanliness, the presence of cavities in the teeth or erosion of the jaw.

(*f*) The presence of supernumerary teeth.

(*g*) Edentulous gums.

Observations on any dental work done in the mouth must be made with reference to stopping, crowning, bridge work, and the material used for the purpose, to the presence of plates of any particular shape and material replacing particular teeth and to any mechanical appliances in the mouth for fixing or supporting any of the above.

It is advisable to submit all such cases to a dentist for examination.

The following old cases illustrate the importance of noticing these points :—

R. v. *Ross*, C. C. C., December, 1831 :

It appeared in evidence that the deceased, Caroline Walsh, an old Irishwoman, had been repeatedly solicited by the prisoner to come and live with her and her husband, but refused. However, she at last consented, and went to the prisoner's lodgings in Goodman's Fields on the evening of August 19th, 1831, taking with her a bed, and an old basket, from which she was accustomed to sell tape and other articles. From that evening all traces of the deceased were lost. The testimony of the prisoner's son, who was the chief witness for the Crown, went to prove clearly that the deceased had been wilfully suffocated, on the evening of her arrival, by his mother (the prisoner) placing her hands over the mouth of the deceased and pressing on her chest. He deposed that on the following morning he saw the dead body of the old woman lying in the cellar of the house, and on the evening of the same day he saw his mother leave the house with something large and heavy in a sack.

Now it happened most singularly that on the evening of August 20th, the day following the alleged murder, an old woman of the description of the supposed deceased was found lying in the street in the immediate neighbourhood, in a completely exhausted condition, and in a most filthy and squalid state. On being questioned she stated that her name was Caroline Welsh, and that she was a native of Ireland. Her hip was found to be fractured, in consequence of which she was conveyed to the London Hospital, where she subsequently died and was buried. The prisoner Ross, when apprehended, asserted that this was the female whom she was accused of having murdered. Hence it became highly important, for the ends of justice, that the identity or non-identity of the two women should be clearly established.

The extraordinary resemblance of names and the exact coincidence of time and place struck every one in court ; but by the examination of about twenty witnesses, the following points of difference were elicited. It was proved that they were both Irishwomen, but Caroline Walsh came from Kilkenny, Caroline Welsh from Waterford. The former (the alleged murdered person) was eighty-four years of age, tall, of a sallow complexion, with grey hair, and had (an extraordinary circumstance for her years) very perfect incisor teeth. The latter, Caroline Welsh (who died in the London Hospital), was about sixty years of age, tall of stature, dark like a mulatto, but had no front teeth, in addition to which it was deposed by a medical witness that the alveolar cavities corresponding to them *had been obliterated for a considerable time*. The witness brought the skull and jaw into court—for the body had been purposely exhumed for his examination—but the judge, Lord Denman, would not allow it to be produced, and said he would be satisfied with the witness's statement respecting the condition of the jaws.

Other circumstantial points of difference were deposed to—as, for example, that Caroline Walsh was healthy, cleanly, and neat in her person, and her feet were perfectly sound. Caroline Welsh was considerably emaciated ; she was in a dirty and filthy condition ; her hip was broken, her feet were covered with bunions and excrescences, and one toe overlapped another. The dress of the two women was somewhat similar. That of Caroline Walsh was proved to have been sold by the prisoner Ross to different persons ; and almost every article was reproduced in court and sworn to by witnesses. The clothes of Caroline Welsh were proved to have been burnt by order of the parish authorities. Both of these women had similar baskets in their possession : that of Caroline Walsh had no lid or cover, while that found on Caroline Welsh had a cover. Last, the body of the latter was taken up from the burial-ground of the London Hospital for the purpose of identification, and it was sworn by two of the grand-daughters of Caroline Walsh not to be the body of their grandmother.

This was a singular case of disputed identity. There was a coincidence of name, time, place, age, occupation, and circumstances, so extraordinary that but for two circumstances it is possible that the prisoner might have been acquitted, the body of the deceased not having been found, although all the dissecting rooms in London were repeatedly searched for it. These circumstances were—first, that the relatives of the deceased swore that the exhumed body was not that of the missing woman;

and secondly, the medical proof of the entire obliteration of the alveolar cavities in the jaw of the exhumed body, proving that the incisor teeth must have been lost long before death, while several witnesses testified to the presence of these teeth as a striking peculiarity in the missing woman. Even had the features of the exhumed body been obliterated by putrefaction, the non-identity would have been established by this medical fact. The prisoner was convicted.

A man was charged with the murder of a woman with whom he had cohabited 14 years earlier and who had disappeared. A dentist stated that a *fortnight* before the woman was missing he extracted the first molar tooth on the left side from the lower jaw. When the exhumed jaw was shown to him, this tooth was absent, and he affirmed that that was the place where he had extracted the tooth. He was thus able clearly to identify the skeleton as that of the missing woman.

At the trial of Webster for the murder of Parkman, the evidence given by a dentist, Keep, established the identity of the mutilated remains of the deceased, in spite of an attempt which had been made to destroy the jaws by fire. He deposed that about four years previously he had made and fitted for Parkman sets of artificial teeth in blocks for each jaw. He saw Parkman with those teeth in his head, for the last time, about a fortnight before his disappearance. He then put a new spring to the teeth. He recognised the artificial teeth, taken from a furnace, by certain peculiarities about them, and also by their fitting the original plates and moulds, which he retained in his possession. The gold plates attached to them had been melted in an assay furnace, in an attempt to destroy the head of the deceased, but the greater part of this gold was recovered, and the artificial teeth, to which the gold plates had been fastened, had acquired a pink colour from a portion of the finely divided metallic gold, showing that they had been submitted to a high temperature, but had not undergone fusion, although minute particles of gold were fused into them. The left side of the lower jaw presented a great natural irregularity. The block corresponded to this, and thus placed the identity of the jaws beyond dispute.[1]

The importance of the teeth as a means of identification of deceased persons was well shown in the case of the French Prince Imperial in 1879. The body had been so much disfigured by his assailants that identification would have been extremely difficult but that the Prince had had four small cavities in the first molar teeth filled with gold, and had met with a slight accident from a blow on the front teeth, which had made it necessary to file them a little, in order to smooth the enamel. These constituted signs which afforded an unerring means of identification.

In the Ruxton case[2] the dental evidence was of definite value although overshadowed by the other ample evidence of identity. The dental history of both women in as far as it could be obtained corresponded in each item with the condition of the jaws of the two victims.

In the case of *R. v. Dobkin*,[3] in which the mutilated remains of a woman were found 15 months after her murder, the dental evidence was of paramount importance. The lower jaw was missing, but in the upper jaw there were four teeth only, three molars on the right side (two of which had been stopped) and the first molar (also stopped) on the left side.

The dentist who had attended Mrs. Dobkin, the missing woman, gave a complete record of her dental state which corresponded in every detail with the dental condition of the upper jaw of the mutilated remains. Before seeing the specimen he drew a dental diagram (Fig. 7) which shews this correspondence as no description can do. He also stated that in removing the 1st and 2nd premolar on the left side he had left a portion of the root, and X-ray examination of the specimen shewed these residual roots. When shewn the jaw the dentist said, "That is Mrs. Dobkin's jaw and those are my fillings." A remarkable bit of evidence in identification.

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[1] Report of trial of Prof. Webster, Boston, U.S., 1850. p 50.

[2] Manchester Assizes, March, 1936.

[3] Medico-legal Review, 1943, 11, 132.

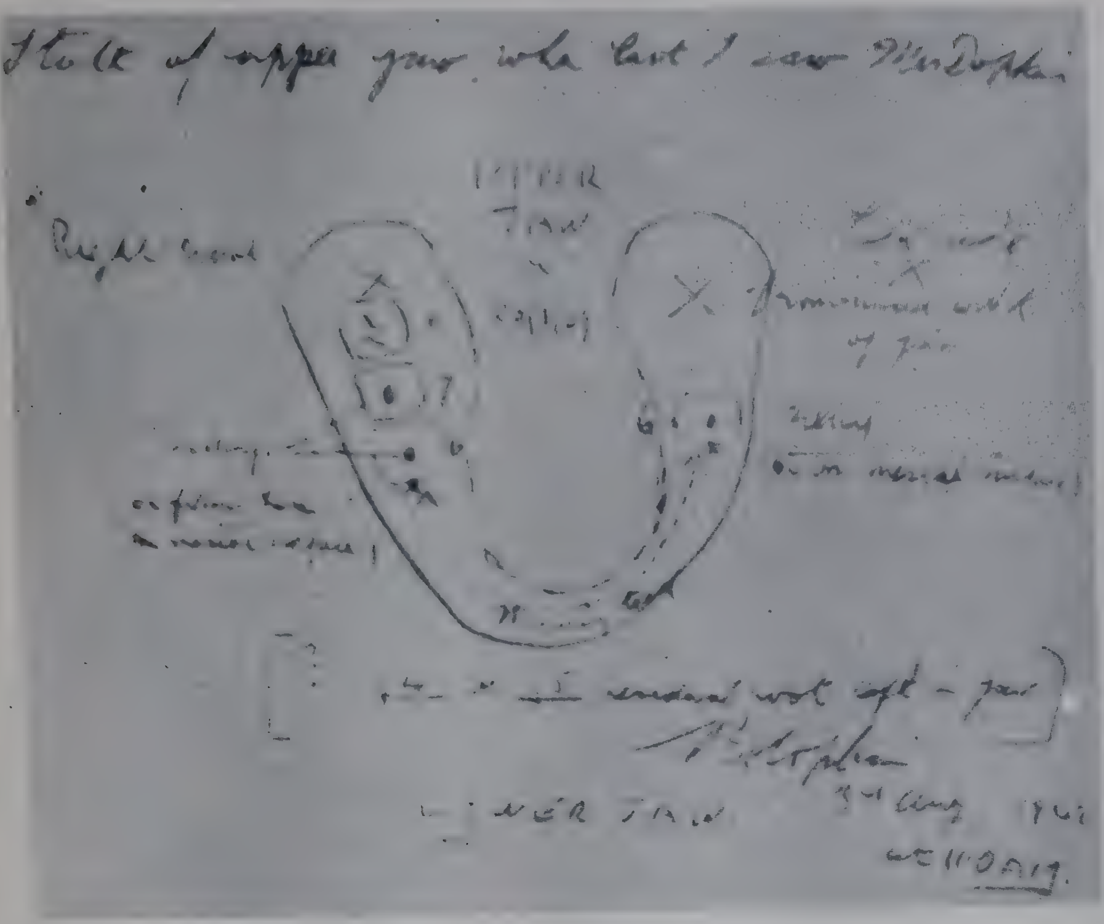
UPPER JAW
LOWER JAW

FIG 7.

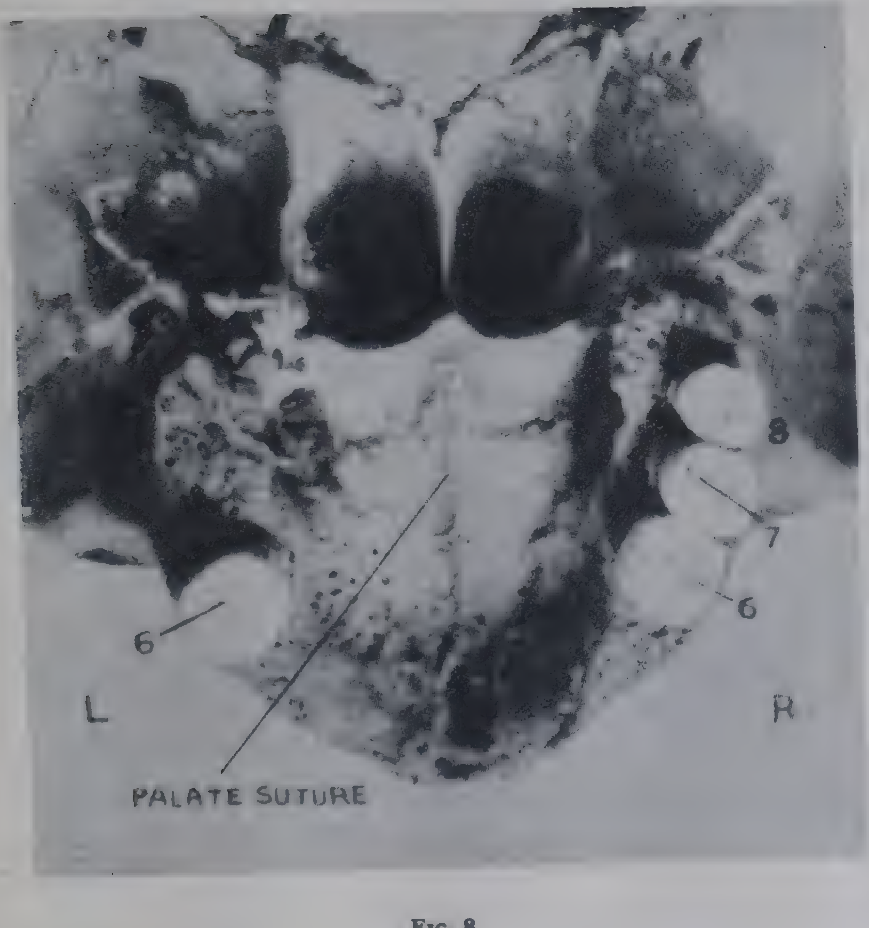
8
7
6
6
L
R
PALATE SUTURE

FIG. 8.

B. The Teeth as a Means of Determining Age

The alveolar cavities which contain the teeth are formed about the sixth month of intra-uterine life, and at birth the rudiments of the whole of the temporary teeth and of the anterior permanent molars may be found in capsules within the gums and jaws; and though it is not till the teeth break through the gums that they are usually used as evidence of age, much information of value may be obtained by radiological examination. From the commencement of the temporary dentition, *i.e.*, about six to eight months after birth, till the completion of permanent dentition, they form a most valuable sign of age in the absence of documentary or other definite evidence. Tidy[1] quotes the following statistics, showing the value of such observations :—

" Out of 1,046 children examined for the purpose, there were 338 who were about thirteen, and no less than 298 of these would have been judged to be thirteen by their teeth alone, while thirty-six more would have been judged to be just below thirteen. There were 708 of nine years of age, and just above; of these 539 were up to the standard of teeth required."

In judging of age by the appearance of the temporary teeth, it has to be remembered that disease may influence the question materially, rickets and other allied disorders of nutrition being well-known agents for delay, while congenital syphilis or possibly its treatment by mercury may antedate the eruption; but such diseases are very likely to betray themselves by the appearance of the teeth themselves, which may be ridged, irregular, or badly formed; and allowance may be made when such teeth are found. It must be admitted, too, that anomalies of dentition quite apart from any recognisable disease are very frequent; thus, many cases are recorded in which a child has been born with one or even two teeth through the gums, and even more frequent are cases in which teeth have been cut by the third, fourth, and fifth months.

The order in which the teeth appear is generally more fixed than the actual date at which any given tooth assumes its position, and hence the total number at any time apparent is of as much importance as their names. The jaws are thus most completely filled with teeth somewhere about the sixth or seventh year, when they contain—without premature loss—no less than forty-eight teeth, twenty perfect temporary, and twenty-eight permanent ones, more or less developed, behind the temporary ones they are to replace, and which can be seen by radiography. In general the teeth in the lower jaw make their appearance before those of the upper. The following table gives the order and average date of appearance :—

Table of Dentation

	Temporary		*Permanent*
6–8 months,	Lower central incisors.	6 years,	First molars.
9 ,,	Upper ,, ,,	7 ,,	Central incisors.
10 ,,	Lateral incisors.	8 ,,	Lateral ,,
12 ,,	First molars.	9 ,,	First bicuspids.
18 ,,	Canines.	10 ,,	Second ,,
24 ,,	Second molars.	11 ,,	Canines.
		12 ,,	Second molars.
		17 to 21, or later	Third molars, or wisdom teeth.

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[1] "Legal Medicine," vol. 1, p. 210.

In growing children the chances of losing teeth from decay or accident e considerable, and allowance must be made for this.

The date of eruption of the wisdom teeth is very variable. They do not sually appear before the seventeenth year and are commonly erupted etween the twenty-first and twenty-fourth years. They may never rupt, or may appear at a very late age. X-ray examination of the gums ay show the teeth in position and the extent of calcification of the ots. The roots should be fully calcified by the twenty-third year, even hen eruption has not taken place.

Scars and Tattoo Marks

The period of time at which a particular wound was inflicted may become a medico-legal question, both in relation to the living and the dead. The identity of a person, and the correctness of a statement made by the accused, may be sometimes determined by an examination of a wound or its scar. If a dead body be found with marks of violence upon it, and evidence be adduced that the deceased had been maltreated at some time before his death, it may be necessary for a practitioner to state whether, from the appearance of the injuries, they could or could not have been inflicted at or about the time assigned. Evidence of this kind once served to disprove the statement made by an accused person, who was charged with maliciously cutting and wounding another. There was a cut upon his thumb, which he accounted for by saying it was from an accident that had occurred three weeks before. The medical witness declared, on examining it, that it could not have been done more than two or three days, which brought the period of its infliction to about the time of the murderous assault. This led to a conviction.

In making an examination of scars or tattoo marks the following points must be carefully attended to and recorded in written notes :—

1. Their number.
2. Their exact situation.
3. Their size and shape and design (tattoos).
4. Their colour, the pigment (tattoos).
5. Consistency—*i.e.*, hard or soft, thick or thin, rough or smooth.
6. Painful or not.
7. Raised or depressed.

Should there be a doubt as to the presence of a scar or tattoo it is a useful plan to rub the part well with the hand so as to excite the local circulation into greater activity ; by this means we are able to get a stronger contrast between the natural and the adventitious colour of the part. A low-power lens should be used in cases of doubt.

Having carefully noted all the above points, then more special questions will arise concerning—

A. Scars

What is a Scar ? How is it formed ? When, from any cause whatever, a solution of continuity in tissues (other than the simple epithelium of the skin) is produced, repair of the injury begins at once. There is an increased flow of blood to the part, escape of an excess of blood-serum which coagulates and not only glues the edges together but acts as a scaffolding for the new repair tissue. White corpuscles migrate from the vessels into the clot, and there is a gradual development and growth of new blood-capillaries, together with numerous fibroblasts. While these cells and new blood-capillaries are young, the tissue which they collectively form is known as granulation tissue, and this granulation tissue fills up the gap formed by the solution of continuity. As the cells become formed into fibres these fibres contract and obliterate the newly formed capillaries; the obliteration of the capillaries causes a change in colour of the scar from red to brown and finally white and the contraction of the new fibrous tissue may distort the original shape of the granulation tissue, and cause the scar to be depressed below the level of the surrounding skin.

A scar, then, is simply fibrous tissue containing no specialised tissues —these are too highly organised in man to be capable of repair by a reproduction of such special tissues. A scar in the skin is fibrous tissue covered with a few layers of simple epithelium that have grown over it, but there is no pigment layer reproduced ; hence any distinctive pigment in a scar is an abnormality probably due to disease, or at any rate it is adventitious, and not part of the scar proper ; in like manner there are no sweat or sebaceous glands or hair follicles in a scar, nothing in fact but fibrous tissue.

In the case of *R.* v. *Crippen*[1] the question of specialised tissues being found in an alleged scar became of some importance ; and it was then pointed out that in stitching up a wound living epithelial cells may conceivably be carried into the depth of the wound, and that a sebaceous or sweat gland or a hair follicle might thus be found in a scar. Very imperfect material for deciding the point was available in the case. An eminent surgeon shortly after the trial stated that he had seen such transferred materials in a scar, but allowing for this there is no doubt about the truth of the above statement that such tissues are not, and, so far as science can tell us, cannot be, reproduced by the processes which form a scar.

Is a Cicatrix the Necessary Result of a Wound ? Assuming that the term wound implies a breach of continuity affecting the substance of the true skin (cutis), then a cicatrix is *always* produced in the process of healing. It should also be pointed out that the same statement holds of a wound of any internal organ in the body. Slight punctures or incisions with a lancet, and even leech bites affecting only the surface of the cutis, may leave no trace after a few weeks or months. In an even cut made by a very sharp instrument, especially if it is in the direction of the fibres of subjacent muscles and the parts are kept in close contact, the cicatrix is even, linear, and sometimes so small as to be scarcely perceptible, and if the skin is white, it may be easily overlooked. Wounds of this kind are not, however, commonly the subject of medico-legal inquiry. If on examining a part where at some previous time a stab, cut, or burn involving the cutis is alleged to have been inflicted, we find no mark or cicatrix, it is fair to assume that the allegation is false, and that no wound has been inflicted, making due allowance for the fact that abrasions of the cuticle, or slight punctures and incisions, often heal without leaving well-marked cicatrices. In looking for such a cicatrix care must be taken to excite the local circulation by friction. as has already been noted.

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[1] *R.* v. *Crippen*, C. C. C., October, 1910.

If a microscopical section of the spot suspected can be obtained it should be possible to identify the presence of a scar, however small this might be.

Time required for Scar Formation. This varies according to the nature, size and position of the wound, and the vascularity of the part and the method of healing. Full consideration of these points would take too much space in a work on legal medicine, but the following propositions may be laid down as reasonable averages with which to compare any given wound :

(i.) In clean incised wounds, such as those made by a surgeon, kept aseptic, the edges are firmly united in about five or six days, and a definite reddish scar formed in something under a fortnight.

(ii.) In wounds which have suppurated healing is greatly delayed and the formation of granulation tissue proceeds very slowly within the wound, starting from the time when the tissues have begun to get the upper hand of the microbes in the struggle for existence ; the time occupied by this is quite indefinite, from say a week to two or three months, according to the size of the wound and the success of the treatment.

(iii.) In small wounds on the fingers, etc., as ordinarily inflicted, a scab forms in about thirty-six to forty-eight hours, and if on removal of this some granulation tissue be found or attempts at scarring, it may safely be said that the wound was inflicted at least four or five days previously.

(iv.) In larger ragged wounds involving many structures caused by *fortuitous* violence no appreciable amount of granulation tissue will be found under a week, and no real scar for at least two or three weeks.

(v.) The age and health of the wounded person have material influence even on these averages, though not always in the expected direction. Thus in many old people a wound will heal quickly, while in an apparently healthy person septic infection may cause much delay.

Age of a Scar. We have seen that a scar consists of fibrous tissue and blood-capillaries, and that the contraction of the former tends to obliterate most of the latter. Hence when first formed a cicatrix looks red or bluish and angry, and is tender. As its age increases it becomes smaller, whiter, denser, more shining and less sensitive ; but there are such wide variations in the time taken to produce these changes that even averages are of no use beyond this, that in about two months or so a scar acquires those permanent characters by which its individuality will be known during the life of its bearer. We have seen scars which after thirty-five years still got red, shiny, and angry-looking when local irritation was applied. When once a scar has become firm and white there are no data of a medical nature which will enable us to say when the wound producing it was inflicted, whether two, ten, or even twenty years before.

Relationship between the Shape and Size of the Scar and the Wound which caused it. Inasmuch as the granulation tissue out of which a cicatrix is formed merely filled the gap produced by the wound, it is obvious that there must be a broad general likeness between a wound and its scar. Thus a straight simple incised wound will have a straight linear cicatrix as a rule, and this will be the nearer the case the closer the edges have been kept in apposition while it was healing, and the more rapidly it healed. If the incision was of some length so that the skin gaped, or if the wound suppurated, the cicatrix will probably be wider and thicker in the middle than at the ends. Wounds of irregular shape and lacerated and contused wounds commonly leave irregular scars, but not every little irregularity of the wound is shown in the scar, especially if of old date, owing to the contraction which tends to distort or obliterate small irregularities. If there has been definite loss of substance in a wound from sloughing, the scar will be proportionately thicker, and if over a bone probably depressed and attached to the bone as the most fixed point.

Besides these propositions there are certain special types of scars that are very characteristic, amongst which may be mentioned :—

Burns and Scalds. These are generally large and irregular, often (in burns at least) showing keloid patches or lines. A scald from water or tea can usually be distinguished from a burn by the peculiar stippled appearance it presents, as though the ducts of the various skin glands were still visible on the surface.

Surgical Operations. These are commonly well indicated by their regular form and situation, and suggest even the reason for their occurrence —amputation, excision, etc. ; the marks of the stitches which held them in position can also be usually made out.

Marks of Cupping. Cupping instruments with their sets of parallel blades are still in use in some parts of Europe, but scars from these instruments are becoming very rare even on immigrants.

Issues and Setons. These are very rarely seen, but Taylor remarked on them : "The cicatrix left by an *issue* ought not to be mistaken for a cicatrix caused by a *seton*. In the first place, it is single, depressed below the level of the skin, and rounded in its margin ; and, as in all cases in which the cutis is destroyed, it remains indelible. It is impossible by any process to restore to the skin its uniformity of surface. A *seton* leaves two cicatrices with a hard band between."

Leech Bites are very characteristic, consisting of small triradiate scars corresponding to the shape of the animal's mouth.

Tubercular and Syphilitic Scars are generally much depressed, irregular and thick in parts ; they are sometimes difficult to distinguish from one another, but they cannot easily be mistaken for the scars of wounds without constitutional disease. The elasticity of the skin, the looseness or density of the cellular tissue beneath, the depression or convexity of the surface and the tension of the muscles are conditions which will modify the form of the ulcer[1] as well as the cicatrix proceeding from it. An expert can seldom do more than distinguish the cicatrices of ulcers arising from morbid causes from those which have resulted from violence. Cicatrices in the inguinal regions raise a presumption that they are of venereal origin, but it is impossible to say that they may not have been derived from simple abscesses. The old cicatrices of *scrofulous* ulcers have some resemblance to those produced by firearms, but it may be presumed that they are of scrofulous origin when they are situated in the region of the neck, below the jaw, or in the course of the parotid gland, especially when there is any enlargement of the neighbouring glands. A puckered and folded state of the skin around the cicatrix would confirm this opinion.

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[1] An ulcer may be defined for medico-legal purposes as an unhealed wound, though the word is used in surgery rather to express the results of disease than those of an aseptic wound.

Vaccination and Small-pox Scars. The cicatrices left as a result of the application of the pure *vaccine* lymph have an irregular honey-combed appearance with white streaks, and are slightly depressed below the level of the surrounding skin. If the vaccination sore becomes infected with common pyogenic organisms the scar may be that of any ulcer. The scars produced by *small-pox* are in the form of deep depressions, showing destruction of the cutis.

Punctured Wounds. Stabs, bullets, etc., generally leave small puckered cicatrices, from which it is generally impossible to give evidence as to the nature of the weapon inflicting them. In wounds alleged to have been caused by projectiles the exit wound should be looked for and if none is found an X-ray photograph of the part should be taken.

Notwithstanding these circumstances, it is, without other circumstantial evidence, frequently very difficult or impossible to say how the wound of which we have only the scar to examine was inflicted. If the person is living, he may give a description of the injury and the date of its production, consistent or inconsistent with the appearances presented.

Removal or Alteration of a Scar by Time. No scar can be removed by cutting or excision without leaving another scar behind owing to the loss of tissue. It is thus obvious that, as regards *artificial* alteration, it not only can be done, but is often done intentionally when the new scar would probably be less disfiguring or harmful than the original one. It is quite possible that a person might thus get rid of an inconvenient scar by substituting another one for it.[1]

Apart from such artificial procedures, it is certain that the scars of wounds involving a definite loss of tissue are permanent and indelible and last through life with but little change. On the other hand, the scars of small wounds that have healed by first intention may become so indistinct as to require great care in discovery. Casper states that he has known the linear scars of cupping disappear after several years. Such cases must be very rare, for all ordinary experience shows that these marks are permanent. If no mark of cutting can be perceived within a few months of the period at which a severe wound is alleged to have been inflicted, it is reasonable to infer that there has been some mistake, or that the circumstances have been greatly exaggerated.

This question was raised in the following case :—

The medical evidence was to the effect that "there was a wound on the nose of the prosecutrix, apparently inflicted by some sharp instrument, and the bridge of the nose was broken down. The weapon had entered half an inch, and had caused profuse bleeding. The wound was so deep that if it had entered a little higher up in the eye, it might have caused death." It was assumed by the jury that a weapon must have been used, and the prisoners were convicted, the one of stabbing and the other aiding and abetting. About six months after the alleged stabbing, and some weeks after the prisoners had been convicted and sentenced to punishment, the face of the prosecutrix was examined by two surgeons (one of them a practitioner of twenty-eight years' standing), and they both deposed that there was no mark of a cicatrix from a stab, of fracture of the nose, or of any personal injury whatever. In consequence the medical facts of the case were referred to **Quain,** Guthrie, Key, and Taylor. The evidence of the surgeons at the trial was laid before them, with the statements of the two surgeons who subsequently examined the prosecutrix. They all agreed that if such a wound as that described in the medical evidence had been inflicted, there would have been a visible scar and a ridge of prominence indicative of the situation where the bridge of the nose was stated to have been broken ; and as no such marks could be perceived by two well-informed surgeons, they considered it improbable either that such a wound as that described could have been inflicted, or that a weapon could have been used in the assault. The medical question really to be decided was. Could all traces of the cicatrix of such a wound as that above described be effaced in a period of six months, or even during the life of a person ? Either the wound must have been misdescribed, or some marks of its past existence in the form of a cicatrix would have been found.

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[1] *R. v. Orton.*

The question of the removal of cicatrices, or rather what can be done to obviate their results, occasionally arises in **civil cases** where the amount of **compensation** is to be determined. Thus deformities of the eyelids produced by burns may be occasionally relieved, joints set free, etc., but it is generally held by the courts that a claimant cannot be compelled to submit himself to an operation to relieve another party of any part of the latter's responsibility. In a case where an explosion of gas had resulted in severe scars of the face causing ectropion with overflow of tears, the judge ruled that the possibility of relief by a plastic operation was not to influence the jury in awarding damages.

EVIDENCE FROM CICATRICES

Such being the guiding principles upon which questions regarding scars may be determined, we have now to see how they have been employed in practice. Cicatrices may be imputed, but frauds of this description are rare, for the wound must be made in anticipation in order to give the appearance of an old cicatrix. It is more likely that an impostor may seek to gain his object by attributing the cicatrices of wounds, accidentally received, to other causes, or by ascribing cicatrices which have resulted from disease to some particular cause occurring in early life. By a remarkable coincidence two persons may have cicatrices on or about the same part of the body produced by cuts, punctures, or abscesses in early life ; and serious mistakes may be made in these circumstances.

In 1794 a man named Lesurgues was convicted and executed for murder. There were doubts at the time as to his identity, and strong exertions were made to save his life. Soon after his execution the real murderer was discovered, between whom and Lesurgues, who had had no hand or part in the crime, there existed a wonderful resemblance in stature, complexion and features. But the most extraordinary part of the case was that Lesurgues, like the real criminal, had a cicatrix or scar on the forehead, and another on the hand ; and there is no doubt that these points of resemblance, which upon a proper scientific examination might have been proved to be really different, led to the conviction of an innocent person.

On the other hand, an impostor, with old scars upon his person, may make use of them as proofs of identity. Such scars may exist; they may be clearly proved to be of old date, and they may be assigned to causes which cannot be disproved except by a close medical examination. The scars may have arisen from scrofulous ulcers or abscesses, in which case it would not be difficult to distinguish them from the cicatrices of wounds.

At the second Tichborne trial[1] the possibility of the disappearance of scars was made a matter of great importance as bearing upon identity. Roger Tichborne the missing baronet, whilst on board the ship *Pauline*, met with an accident by which a fish-hook passed through one eyelid, and had to be pulled through and out; and it was truly alleged that such a wound would leave a scar, and that this would probably be indelible. He had also been bled, an operation which usually leaves indelible scars. It was also certain that, when a lad, Roger had either an issue or seton on his left arm. According to the prosecution it was an issue, and was kept open by a pea. According to the defence it was a seton. On the defendant's arm there was the mark neither of an issue nor of a seton. Moreover, there was no scar on the eyelid such as would have been produced by the fish-hook. Further, Roger had his temporal vein opened when a young man; and there was no scar on the defendant's temples. Although it was admitted that a venesection mark might disappear in the course of time, it is in the highest degree improbable that several cicatrices such as have been described would all disappear. The defendant was convicted of the attempted imposture, or rather of perjury, in swearing at the first (civil) trial that he was the veritable Sir Roger Tichborne.

It may be alleged, in proof of identity, that at a former period of life certain operations had been performed on the body of an individual and the physician may have to determine whether such scars as are present have been the result of the alleged operation. If they are not visible at the time of examination the question whether they may have spontaneously disappeared by lapse of time may have to be decided. Such simple questions may carry with them momentous issues, either in a civil or a criminal case; they can be answered by reference to the above paragraphs and cases.

Beck quotes the case of a child, who had been bled in the right arm when sixteen months old. When nearly four years old the child was lost, and two years subsequently the godmother, seeing two boys pass, was struck with the voice of one of them; she called him to her, and was convinced that it was her lost godson. The identity was also considered to be proved by the discovery of a cicatrix from bleeding in the right arm, and a cicatrix from an abscess in the left knee, both of which were present in the lost child and also in the one that was found. The latter, however, had upon his body marks of the small-pox, while no marks of this kind were on the body of the former. The child was claimed by a widow (Labrie), and many witnesses deposed that it was really her son. The court decided in her favour, chiefly on the ground that the lost child was not marked with the small-pox. It was admitted that this child had, on the arm and knee, cicatrices similar to those which were known to exist in the one that was missing; and had the medical witnesses agreed about the causes of them, it is probable that the decision would have been different. The cicatrix on the knee was ascribed to the use of caustics by some of the surgeons, and to a slight tumour or abrasion by others. The widow Labrie admitted that her child had never been bled in the arm, while the missing child had certainly undergone this operation; but on the question of the presence of a cicatrix from bleeding there was a conflict of medical opinion. Three surgeons examined the cicatrix, and declared that it had been made with a sharp instrument. Others deposed that it was not a cicatrix from bleeding, but from the opening of an abscess. As the child had been missing two years, it might have had small-pox in the meantime.

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[1] *R.* v. *Castro*, L.R. 9 Q. B. 350

From the medical evidence, the case seems to have been wrongly decided.

B. TATTOO MARKS

Small punctured wounds made into the true skin with needles dipped in colouring matter leave marks which may or may not be indelible, according to the mode in which the operation is performed. Tattoo marks have been made use of as evidence in many cases of identification. The colours commonly employed in tattooing are indigo, charcoal (gunpowder), China-ink, and vermilion. Although China-ink and charcoal are black, the effect when introduced into a white skin is to produce either a blue or bluish-coloured mark. The foreign matter thus introduced mechanically into these minute punctured wounds causes inflammation, but this soon passes off, and the colouring matter then remains permanently encysted in the substance of the cutis, or below it. It is there found after death.

So far as identification is concerned, tattoos differ materially from scars, for the latter are the result of what may be called accident or the vagaries of disease, and hence multiple scars of identically similar position and nature on different individuals are exceedingly improbable. Tattoo marks, on the other hand, are the result of deliberate intent, and are often produced in many individuals by the same operator—a sailor or soldier, for instance, operating on his comrades—who may from choice or ignorance reproduce the same design with endless repetition. Hence two individuals who have been under the hands of the same operator might present tattoo marks of position, nature, colour and design so similar as to be practically identical. On the other hand, designs of the most elaborate and exquisite character are often produced by experts in tattooing, and such designs might form a certain means of identification.

There are two medico-legal questions connected with these marks which now and again become of great importance : Can they disappear naturally ? Can they be removed artificially ?

Natural Disappearance of Tattoo Marks. The design itself consists of solid (ordinarily insoluble) particles of pigment which have reached, and remained fixed in, the outermost layer of the true skin or in the deepest layer of the epidermis, in the layer, that is, which is never shed bodily, but which keeps on multiplyng to provide the more superficial layers. Hence the natural process of disappearance consists in gradual conveyance in solution, convection of particles into the lymphatic channels or convection by cells towards the surface ; the efficiency or permanency, therefore, depends very materially on the indestructibility and insolubility of the particles of pigment, and on their reaching a situation to which phagocytic cells have ordinarily but little access. Thus it is found that vermilion and ultramarine have the least resisting power against disintegration and solution, while Indian ink and soot or carbon have the greatest ; and that the best situation is just below the epidermis in the firmest layer of the true skin. Tidy goes so far as to assert that a design once efficiently inserted and made of carbon never disappears by natural means, and all authorities agree that ten years is the shortest time in which tattoo marks can disappear.[1]

It must be admitted that tattoo marks are not necessarily indelible, but they have been observed to remain for fifty years and upwards. In old marks the red and blue portions may become very indistinct, while the black portions of the pattern are still easily traced. The situation of the marks has also something to do with the rapidity of disappearance. Thus they would naturally disappear more easily from a place, such as the hand, where severe friction was of frequent occurrence, than from the chest or upper arms.[2]

Artificial Removal of Tattoo Marks. The application of caustic and blistering fluids to the part or the galvano cautery may cause the removal of tattoo marks, but the process is almost bound to result in the production of a scar.

Skillem[3] recommends glycerole of papain as the most efficient and least painful agent. It is pricked in over the tattoo marks after desensitisation with ethyl chloride spray. The following has also been suggested. Salicylic acid made into a paste with glycerine is applied over the marks with a compress and strips of adhesive plaster and is allowed to remain in contact for some time. After the first dressing the epidermis over the marks is removed, and a fresh application of the salicylic paste is made. Usually the second application removes the marks, but sometimes it is necessary to make a third. The treatment must be applied very cautiously.

On the occasion of the second trial of the claimant of the Tichborne estates the possibility of the effacement of tattoo marks became a prominent question.[4] It was well known that the missing baronet had been tattooed along the whole length of the forearm. The claimant had no tattoo marks, nor any signs of tattooing ; but above the left wrist there was a large scar, as if a piece of the skin had been cut or burned out. Ferguson and Holt stated that nothing would remove a tattoo mark short of the knife or a cautery. The man Orton was said to have had the letters " A. O." tattooed on his arm. Evidently a clumsy attempt had been made to obliterate the implicating letters " A. O." on the wrist.

One of the most remarkable cases of identification from a tattoo mark is, no doubt, the so called Sydney shark Case.

A man called James Smith disappeared on April 8th, 1935, and was never seen again. On April 22nd a shark was caught off the beach at Coogee and was sold to the Aquarium—where after three days it vomited up a quantity of material including a human arm.

The arm, which belonged to an adult male, was in a fairly good state of preservation, and, according to the medical evidence, had been severed from a dead body, not by a shark bite, but by a clumsy incision with a sharp instrument. On the forearm there was a tattooed design of two men boxing.

Several missing men whose arms were tattooed were investigated and finally the search was narrowed to two men of which James Smith was one. Smith's wife and brother both definitely identified the arm as that of Smith and finger-print experts were able to support the identification. An arrest was made of an associate of Smith, one Patrick Brady, who was tried for murder at the C.C.C., Sydney, on September 9th, 1935. Truly a unique series of coincidences which led to positive identification of the missing man.

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[1] 1 Casper, E. Tr. p. 105.

[2] See *J. Amer. Med. Ass.*, January 14th, 1928, for an exhaustive article on tattooing.

[3] *Philadelphia Medical Journal*, June 18th, 1898.

[4] *R.* v *Castro*, Q. B. 1873.

Sex

Apart from sexual crimes, the identification of the sex of any given individual is naturally a very important matter in the ordinary meanings attached to the word identity, and it must be considered here; but as the point has other important bearings in legal medicine, for which there seems to be no more appropriate place of introduction in this work than the present, it will be discussed fully once for all in its practical relationships.

Sex may require to be established positively in one direction or the other for the following reasons:—

1. For purpose of simple identification in a living or dead person.

2. For purposes of deciding whether an individual can exercise certain civil rights reserved to one sex only.

3. For deciding questions relative to legitimacy, divorce, paternity, and affiliation.

We may consider the evidence that is available for determining sex and discuss its abstract value.

Evidence of Sex

This may be divided into three categories: (1) the presumptive, (2) the highly probable, and (3) the certain. To the first category belong all such points as the features and general contour of the face and the presence or absence of hair upon it, the length of the hair on the scalp, the clothes, the figure, the habits and inclinations, the voice and many other almost intangible minutiæ of everyday experience. To the second category belongs the possession of vagina, uterus, and accessories, and large breasts in the female sex, structures which are incidental to the needs of the ovum for impregnation, safe protection, development, and nutrition during intra- and extra-uterine life; and in the male sex the possession of prostate gland, vesiculæ seminales, and penis, which are accessory to the introduction of the sperm. The third category consists in the possession of an ovary by the female and in the possession of a testicle by the male.

Presumptive Evidence. In the ordinary associations of everyday life this is usually, one must admit, accepted as sufficient, but cases in which the sexes change clothes for purposes which range from purely innocent through the mischievous down to the most vilely criminal are very frequent, especially in the haunts of prostitution. The detection of such cases as a rule requires nothing but the ordinary knowledge of the detective or female searcher.

In some cases the condition of the hair gives rise to certain doubts which may be and usually are speedily set at rest.

In old women it is not unusual to see a growth of hair on the chin and lips, but it would not always be safe to rely upon this as evidence of the male sex at any time of life.

M. C., *æt.* 42, was admitted into the Norfolk County Mental Hospital suffering from mania. She had a vigorous growth of hair on the lips and chin, for which depilatories had been used, but these made matters worse. The upper part of the body was masculine in form, and the breasts were undeveloped, as in the male sex. The lower part of the body was feminine in outline, and the voice had the feminine tone and character. The clitoris was largely developed, having a distinct prepuce. There were no testicles in the labia or in the inguinal canals. There was a distinct vagina, and the finger appeared to touch an os uteri. At an early age she had had the slightest possible signs of menstruation on three consecutive occasions. In her girlhood she would not associate with other children. While in the hospital she evinced strong sexual passions, and behaved indecently to the nurses. She had a thick moustache and a full beard.

Such abnormalities of hair in the female sex are not infrequently associated with sexual malformations.

It is unnecessary to make any very serious allusions to the numerous cases in which, relying on such presumptive evidence, persons have passed through life without suspicion that they were not of the sex supposed. The following case is of interest, as it refers to a public official :—

A remarkable case, in which a female had successfully personated a male for many years, occurred in 1865. The case was that of *Dr. James Barry*, who was well known as Staff Assistant Surgeon and Inspector of Hospitals. In the following description the sex is retained under which Barry was known while living. He died in 1865, at the age of eighty, and although suspicions had existed among those who had personally known him that he laboured under some sexual defect, it was only proved after his death that he was really a woman. He is reported to have been the illegitimate child of a nobleman. When, where, and how he passed through his medical studies no one knew, but he contrived to obtain a diploma as Doctor of Medicine from Edinburgh when only fifteen years of age. The young physician entered the army, and served much abroad. In due course he retired from the service, received a pension, and was made Inspector of Hospitals. In 1857-8 and subsequently his appearance and manners were effeminate. His face and hands were smooth and white, like those of a woman ; he had no beard or whiskers. He was thin, and in stature resembled a woman, his limbs being small, but in good proportion. His voice was shrill and squeaking, quite unlike that of a man. The impression left upon the mind of all those who saw him was that he laboured under some sexual malformation. After his death, however, it was found that he had the sexual organs of a woman. He had specially desired that no *post-mortem* examination of his body should be made, but this order was disobeyed, a special report having been ordered by the authorities. It is difficult to comprehend how, in assuming the attributes and duties of an army medical officer, he could have so successfully maintained the deception through a long life. Whether he menstruated or not does not appear. He is said to have always worn a peculiar and tight-fitting dress.

Highly Probable and Certain Evidence. Such evidence must be considered together, but in the *living* it is only the highly probable that can be used, while in the dead the existence of ovaries or testes can be proved with certainty.

We have already enumerated the ordinary naked-eye points of evidence. In order to understand how doubts can arise about the meaning of what is seen, it is necessary to give a brief outline of the development of the sexual organs.

The following table gives the scheme in condensed form :—

INTERNAL PARTS

	Mass of Germ Epithelium	
Female.[1]		*Male.*[1]
Ovary (?).		Bulk of testicles (?).
	Mulleriam Ducts (Ducts of Pronephron).	
Fallopian tubes. Hydatid. Uterus and vagina.	Their non-union produces the anomalies of uterus bicornis, etc., or double vagina.	Hydatid of Morgagni. Uterus masculinus in prostatic urethra.
	Wolffian Bodies (Mesonephron)	
Parovarium.		Vasa efferentia (coni vasculosi).
Paroophoron.		Organ of Giraldés, vasa aberrantia.
Round ligament.		Gubernaculum testis.
	Wolffian Ducts	
Chief tube of parovarium.		Convoluted tube of epididymis.
Ducts of Gaertner.		Vas deferens and vesiculæ seminales.
	Metanephron	
Kidney and ureter.		Kidney and ureter.

EXTERNAL PARTS

	Genital Eminence	
Clitoris.		Penis.
	Cutaneous Folds	
Labia majora.		Scrotum.
	Cloaca	
Rectum.		Rectum.
Vagina.		Connective tissue.
Urethra.		Urethra.

The table may be explained as follows :—At a very early period in fœtal development there is found a single mass of cells at the back of the abdomen. This soon divides into two, one on each side of what will afterwards become the bodies of the vertebræ. From each of these masses is developed a series of glands and ducts, of which the glandular parts remain separate in the form of two testicles or ovaries, and two kidneys ; the ducts at their upper ends also remain separate as ureters in both sexes, and as the Fallopian tubes in females. The parts in the male corresponding to Fallopian tubes in the females remain as fœtal remnants ; the lower ends of the two ducts unite and form in the female the uterus, and in the male a small fœtal remnant. None of these changes in the internal parts, or rather in the parts inaccessible without an operation, is of much interest to the medical jurist with one important exception, and that is the changes of position in the testicles. These should normally lie at the sixth month of intra-uterine life on the psoas muscle, at the seventh month near the internal inguinal ring (a spot on the anterior wall of the lower abdomen), at the eighth month in the inguinal canal, and at the ninth month in the scrotum. If these changes of position do not occur we get the condition known as retained testicle (cryptorchism), and if both remain actually within the abdomen, the apparent absence of testicles is an approach to the appearance of a female, in which the ovaries are normally in that situation. *Per contra* in the female sex an ovary is occasionally drawn down outside the abdomen, and appears in the labium majus, thus producing an approach to the male conformation.

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[1] Organs in the two sexes thus derived from the same fœtal structures are spoken of as homologous organs, and, owing to this similar origin, may, by fœtal mistakes in development, more or less closely resemble one another (each in the opposite sex).

The external parts, or those accessible to inspection without operation, are of the greatest interest to the medical jurist in the determination of sex. In the early days of development there appears at the lowest part of the abdomen the genital eminence, which consists of a central prominence with two diverging wings, one on either side, with a wide aperture between these wings. In its very earliest state this aperture is really a common cloaca, into which open both urinary and fæcal outlets. By an ingrowth of tissue the rectum or fæcal outlet is soon separated off, and its anomalies are of interest only to the surgeon. In the anterior division of the cloaca the changes in the two sexes proceed on very different lines. In the male the two diverging wings of the genital eminence unite in the middle line and form the scrotum into which the testicles descend, while from the angle between them grows the penis, with its corpora cavernosa and the corpus spongiosum, enclosing the urethra. The remainder of the anterior division of the cloaca grows up entirely into connective tissue, with the exception of the urethra. In the female the two diverging wings remain separate, leaving a space between them which constitutes the vulva, the vagina being formed out of the middle portion of the original cloaca. The urethra, as in the male, is a small anterior portion separated from the vagina by an ingrowth of connective tissue. From the angle between these diverging wings the clitoris develops in the same way as the male penis, but it does not enclose the urethra, the opening of which is situated in the middle line below the clitoris. It will thus be seen how easily mistakes may occur in naming the sex of a new-born infant. The penis has only to be very small to be precisely like a clitoris, and the clitoris large to be like a penis ; the labia majora have only to unite to present the appearance of a scrotum, and the halves of the scrotum to remain separated to have the appearance of labia majora ; and these anomalies have only to be present with internal organs that do not correspond to produce a bewildering variety of forms of real or apparent confusion of sex.

Hermaphroditism should strictly include only a combination of the essential organs of generation of both sexes (testes and ovary) in one individual, but the term as usually understood is enlarged to cover all the above anomalies.

To determine the sex of a given individual, a very thorough examination is necessary both of the external genitalia and of the internal structures to be felt by a bimanual examination. In infants, and adults without definite vagina, the rectum must be used for the purpose. If a definite uterus is felt, it settles the question in favour of a female, whatever development the external parts may have undergone. If no gland nor uterus can be felt, then the external organs assume greater importance.

The above facts of development constitute the principles which guide one in a decision. On the one hand, in a male person the lack of union of the cutaneous folds (hypospadias) and lack of growth of the genital eminence (the penis), on the other hand, in a female person the excess of union *of the folds* and the excess of growth of the clitoris, constitute in their various degrees the real difficulties.

If the local examination leaves one still in doubt, the other sexual characteristics must have the greater weight attached to them, such as the hairiness of the skin in general, more marked in males, the development of the breasts, the instinct of the individual for *amours*, which must be assumed as inclining to the opposite sex, menstruation, etc., etc., though that these points may all be fallacious is proved by well-authenticated cases of individuals having to change their apparent sex as a result of a medical examination even as late as twenty or twenty-five years of age, and that, too, after sexual connection of an inverted character has long been indulged in.

In tumours of the suprarenal gland masculine characters may develop in the female, hair may be profuse in quite young children, the genitalia may so develop that an appearance of pseudo-hermaphrodism is produced, the sex organs of the female closely resembling those of the male. Sexual precocity may occur at quite early ages. A similar precocity may occur with tumours of the pituitary gland.

We may now quote a few typical examples of difficulty in determining sex in the living until operation cleared up the matter.

"*A Case of Spurious Hermaphroditism (Hypospadias and Undescended Testes in a Subject who had been brought up as a Female and been married for Sixteen Years).*[1]

"A woman, forty-two years of age, was recently admitted on account of a painful swelling in the left groin. She stated that a fortnight previously she was lifting some heavy furniture when something seemed to give way in her stomach; she felt very sick and had an acute pain in her left groin; on feeling the groin she found a tender swelling there; when she lay down it got smaller, but on her again rising the swelling regained its former size. The severe pain did not last long, and she was able to follow her occupation, but she was always in more or less pain and discomfort, and the swelling seemed to be slowly enlarging, so at the end of a fortnight she deemed it advisable to seek medical advice and went to the hospital. The notes state that on admission she was of somewhat masculine appearance, the breasts were well developed, but the nipples were rudimentary, and the areolæ were not marked. There was no hair on the face, and there was but little on the pubes. An ovoid solid body feeling just like a testicle rather above the usual size occupied the left inguinal canal. A similar but smaller swelling was observed in the right groin; this was not tender, and the patient was not aware of its existence until her attention was called to it. The external genitals were normal in appearance, and the vagina was of normal calibre and length, but the finger introduced into the canal demonstrated a *cul de sac*. No os or cervix uteri could be felt, and a bimanual examination failed to detect the presence of a uterus. The patient had been married for sixteen years, and her husband had died within the last year; she had never been pregnant, and neither she nor her husband had any idea that she was in any way different from other women. She began to menstruate at the age of twelve years, at first not very regularly, but from fifteen to thirty-eight years of age she never missed the catamenial flow every four weeks, and it always continued for twenty-four hours, and no longer ; in the interval she had a constant white discharge. The diagnosis lay between hernia of the ovary and partially descended testicles, for although the patient had lived as a woman and, according to her statement, menstruated regularly, Mr. Andrew Clark could not put from his mind the idea that these bodies were testicles. The patient was placed under ether, and an incision was made over the left swelling, the sac was opened, and what were to all appearances an ordinary testicle and spermatic cord were drawn out of the wound.

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[1] The *Lancet*, 1898, 1, p. 719.

" *Remarks by Mr. Andrew Clark.* ' I would first remark that there was no doubt about the nature of the organs removed. They have been carefully examined, and both were in structure identical with the testicle ; no spermatozoa were, however, found. I have called the patient " she," though, as far as we were aware, she had none of the essential generative organs of the female, but having always lived as a woman, I did not think it necessary or even fair to inform her of what we had discovered, and when she left the hospital she believed, as far as I am aware, that she had been suffering from an ordinary rupture which had been cured.

" ' There are many cases of hernia of the ovary on record, and in the account given of some the suggestion of the supposed ovary being a testicle is made, and there are some in which when the bodies have been removed they have proved to be testicles ; but in all these cases, as far as I know, the individuals have not menstruated, been married, and lived to the age of forty-two years in ignorance of their condition. There was no evidence that this person was a hermaphrodite, there was no uterus, at any rate not large enough to be felt, and there was no evidence of ovaries. I cannot account for the regular menstruation, but I am inclined to take the statement regarding that *cum grano salis*, for there was absolutely no opening to the vaginal tube. I consider that the patient was really a man with a very ill-developed penis in a condition of hypospadias.'."

In the *British Medical Journal*, 1, 1902, p. 541, will be found a case in which a " man " had an ovarian cyst removed from his abdomen.

A case is described[1] on which after operation Mr. E. P. Paton, M.S., made the following remarks :—

" In this case the following seems to be the condition of the sexual organs. Externally the penis was small, but otherwise normal except for the fact that the urethra had no floor. What appeared to be the opening of the urethra was really the opening of a very rudimentary vagina, into which the uterus opened by a fair-sized aperture, and the urethra by a very small one ; the folds on either side of the opening in the perineum might be taken to be either rudimentary scrotum or labia. Internally there were a very fairly well-formed uterus and tubes, and on the left side the gland, which was removed, was clearly a testis ; it was uncertain if there was a similar gland on the right side. There was no evidence of the existence of epididymis, vas deferens, or prostate, but it was quite possible that these might be present in a rudimentary form, as no examination to settle this point could of course be made. The bladder was normal save for considerable increase in size. The general build of the individual was rather of the female than of the male type."

In the *Lancet*, 1, 1900, p. 1884, Mr. G. R. Turner was reported to have removed a testicle from a " girl " of fourteen supposed to have been ruptured from birth. It was really a testicle in the canal.

Sex in Simple Identity need not be further considered here, but it should be definitely stated that if an ovary can be proved microscopically to be present the person is a female ; if a testicle can be similarly proved the person is a male ; if both can be proved to be present it is a hermaphrodite.

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[1] The *Lancet*, 1902, 2, p. 148.

A large number of similar cases are reported in many medical journals. They show how difficult questions of sex may be when required to be answered in connexion with civil rights and duties in cases where the person whose sex is to be determined is alive and will not submit to an operation.

The following case occurred in America :—

At an exciting and warmly contested election in the United States of America in 1843 almost everything bearing the semblance of the human form of the male sex is stated to have been brought to the ballot-box. It was at this time, and under these circumstances, that Levi Suydam, aged twenty-three years, a native of Salisbury, Con., was presented by the Whigs to be made a free*man* ; he was challenged by the opposite party, on the ground that he was more a female than a male, and that in his physical organisation he partook of both sexes. There was a mons veneris, covered with hair in the usual way ; an imperforate penis, subject to erections, about two and a half inches in length, with corresponding dimensions ; the dorsum of the penis was connected by the cuticle and cellular membrane to the pubis, leaving about an inch and a half free, or not bound up, and towards the pubic region. This penis had a well-formed glans, a depression in the usual place of the outlet for urine, with a well-defined prepuce. The scrotum was not fully developed, inasmuch as it was but half the usual size, and not pendulous. In the scrotum, and on the right side of the penis, there was one testicle, of the size of a common filbert, with a spermatic cord attached. In the perineum, at the root of the corpora cavernosa, an opening existed through which micturition was performed ; this opening was large enough to admit the introduction of an ordinary-sized catheter. Having found a penis and one testicle, although imperfectly developed, Barry, without further examination, gave it as his opinion that the person in question was a *male citizen*, and consequently entitled to vote and enjoy all the privileges of a free*man*. On the morning of the election day Ticknor objected to him as a *female*, and therefore not entitled to vote. Barry then stated to the meeting that, from an examination he had made, he considered the person in question to be male ; and requested that Ticknor might, with the consent of Suydam, retire into an adjoining room, and examine him for himself. This was done, when Ticknor ultimately came to the conclusion that this person was really a male. He was accordingly admitted a free*man*, and his vote was received and registered. A few days after the election Barry heard that Suydam had regularly menstruated as a woman. His sister informed Barry that she had washed for Suydam for years, and that he menstruated as regularly, but not as profusely, as most women. When questioned, he very unwillingly confessed that such was the fact. He was again examined by the two physicians, when the following additional particulars were elicited :—Suydam was five feet two inches in height, light-coloured hair, fair complexion, with a beardless chin and decidedly a sanguineous temperament, narrow shoulders, and broad hips—in short, every way of a feminine figure. There were well-developed breasts, with nipples and areolæ. On passing a female catheter into the opening through which micturition was performed, and through which he stated he had a periodical bloody discharge monthly, instead of traversing a canal and drawing off urine, the catheter appeared to enter immediately a passage similar to the vagina, three or four inches in depth, and in which there was a considerable play of the instrument. He stated that he had amorous desires, and that at this time his inclination was for the male sex. His feminine propensities, such as a fondness for gay colours, for pieces of calico, comparing and placing them together, an aversion for bodily labour, and an inability to perform the same, had been remarked by many. Barry further learned from an old lady who was present at the birth of Suydam that on the second day after his birth Delamater, who attended as accoucheur, made with an instrument the opening through which he had ever since performed micturition.[1]

The presence of a penis and one testicle referred the being to the male sex, while the bodily configuration, and still more strongly the periodical menstrual discharge referred him to the female sex. The right of voting might have been fairly objected to, because, while the female features were decided, the organs indicative of the male sex are described as having been imperfectly developed.

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[1] *Amer. Jour. Med. Sc.*, July, 1847, p. 123.

Sex in Matrimonial Suits, Legitimacy, Paternity, and Affiliation. In such cases as these the question of the determination of a definite sex is of comparatively little importance compared with the questions, is this person physically incapable of procreation, whether as father or mother? Is the malformation such as to justify a suit for nullity of marriage on the ground that the person is incapable of proper sexual intercourse? Could this person possibly be the father or mother of this child? These questions are dealt with fully in Vol. II.

Such cases seldom come before the British courts, and are still more seldom reported with any details; the individuals in question would almost without exception be both impotent and sterile, and yet there is no reason why any of them who survives infancy should not live to a marriageable age, and even go through the ceremony of marriage in ignorance of the real state of affairs.

When these beings have reached adult age, other questions may arise in regard to them. The English law does not allow them to select their sex, but determines it for them by medical evidence. Hermaphrodites, or sexual monsters, were formerly classified with infamous persons; and it has been a grave question in the English courts whether describing a man as a hermaphrodite was not such a libel or slander as to render it a ground for a civil action. In a case reported by Chitty,[1] the use of this term was held not to be actionable, unless it was proved that it had been attended with special damage. A dancing master brought an action against a person for calling him a hermaphrodite, and it was decided that it was not sustainable—(i.) because it was asserted that such a union of the sexes cannot exist in fact, and everyone must be supposed to know it: consequently the assertion could not be supposed to prejudice; (ii.) because, admitting the possibility of such a double function, the party would be just as good, and perhaps even a safer, dancing master than if only one perfect sex had been discoverable: consequently the words would not, in legal presumption, injure him in his profession or occupation.

Hartshorn quotes a case in which an attempt was made to destroy all sexuality, and thereby all rights of citizenship, in an infant whose sexual organs were imperfect.[2]

The child was three years of age, and had always up to that period been regarded as a girl, and in fact had been so pronounced at her birth by the accoucheur. At the age of two years she began to evince the taste, disposition, and feelings of the male sex; she rejected dolls and similar articles of amusement, and became fond of boyish sports. She was well grown, perfectly healthy, and quite fleshy. Her hair was dark and long, the eyes black, and the whole expression most agreeable. A careful examination of the external genitals disclosed the following circumstances: There was neither a penis nor a vagina; but instead of the former there was a small clitoris, and in place of the latter a superficial depression or *cul de sac* covered with mucous membrane, and devoid of everything like an aperture or inlet. The urethra occupied the usual situation (in the female ?) and appeared to be natural; the nymphæ were remarkably diminutive, but the labia were well developed, and each contained a well-formed testicle quite as large and as firm as this organ generally is in boys at the same age. The hips, chest, thighs, and upper limbs were perfect. It was considered that, for the child's future welfare and happiness, it would be better that it should have no testicles at all than that it should retain them under such an imperfect development of the other organs. They were therefore removed by operation from the labia or divided scrotum, and they were found perfectly formed in every respect, and the spermatic cords were quite natural. Three years subsequently it was found that emasculation was complete, for the disposition and habits of the being had materially changed, and were those of a girl; she was found to take great delight in sewing and house work, and she no longer indulged in riding on sticks and other boyish exercises.

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[1] "Med. Jur.," p. 374.

[2] *Amer. Jour. Med. Sc.*, October, 1852; *Edin. Month. Journ.*, January, 1853.

The reasons assigned for the performance of this operation—namely, the entire deprivation of sex, and thereby of any sexual feelings in after-life—appear to be unsatisfactory. It is clear that this being was deprived of the rights and privileges of a *male* by the removal of the testicles. In England it might have been a question whether the operator had not rendered himself liable in damages.

The determining of the sex of a child by a proper examination at the time of birth, and the making a note thereof, is a special duty of the accoucheur.

Re-registration of Cases of Sex Error. In any case in which an error has been made about the sex of a child the parents or guardians should not neglect to re-register the birth of the child. The following procedure is to be followed in re-registering a child :—

> " Application for the re-registration of the birth should be made to the Registrar-General accompanied by the particulars of the case by the medical practitioner who has examined the child. If this is satisfactory the Registrar would be instructed to re-register the birth on the information of one of the parents or other informant qualified under the Births and Deaths Registration Acts. Should there be no qualified informant available, then the original entry would be corrected on the authority of a statutory declaration, made by two persons cognisant of the facts, one of whom would be the medical practitioner."

Hair

The value of the hair in identification is tolerably obvious under ordinary circumstances, but as it can be artificially altered by dyeing or bleaching, and as also it is very resistant to putrefaction, many medico-legal questions may arise concerning it, and the subject may be dealt with here in all its aspects to avoid repetition.

HAIR AS A FACTOR IN IDENTIFICATION

This is a matter principally of colour, character, length and distribution.

Colour in its natural state offers but little means of positive identification beyond the fact that the hair on the dead body is of the same colour as that of the missing person. The different shades of colour (reds, browns, whites, and yellows) are indeed very numerous, but they are nothing compared with the number of individuals in the world. It may of course happen that there may be something very peculiarly striking in the colour of the hair of a corpse either in its totality or in some special patch of it, such as a lock of white hair in the midst of a head of dark hair which in a limited population, such as a small town or village, might become of great corroborative importance if the age and other points were approximately those of the individual known to be missing.

The colour may be artificially altered, and medical jurist must be acquainted with the commoner means employed for such purposes, and how they may be detected. The means employed are of two broad classes (*a*) substances applied to the hair which by their presence *conceal* the colour; (*b*) substances which *alter or destroy* the colour. Amongst the former lampblack to obtain a black colour and flour, chalk, etc., mixed with some greasy substance to obtain a white colour may be used, but are easily detected by washing the hair or brushing it in water, when the particles will be removed more or less completely, and may be observed in the water with the naked eye. They may also be detected by simple chemical tests. The latter are a little more difficult to detect, but the fact of dye having been used is usually suggested by one or two simple observations. Thus (*a*) it will commonly have been applied to the hair of the head only, the public and other hair having been left untouched. (*b*) If it has not been applied recently the bases of the hairs will show a short length of the natural colour by growth since the application. (*c*) The microscope will generally show that the dye has left small spots and patches untouched, the trunk of the hair showing different colours. (*d*) The skin of the scalp or face may also show contamination from the dye. Bleaching substances, such as chlorine and peroxide of hydrogen, used to produce golden locks, have a tendency to make the hair brittle, and hence may be detected by the frayed condition. Organic dyes such as the paraphenylin diamines are mostly used for dyeing the hair brown or black. Lead and bismuth are occasionally used for dyeing purposes. If they are suspected, the hair may be digested with strong nitric or nitrohydrochloric acid, and the resultant liquid tested for these metals. It is not difficult as a rule to decide whether the hair has or has not been dyed.

Character. There are many characters of hair which may serve as corroborative points in identity either of a person or of a given individual hair, but they are mainly those denoting the race from which the person came. The curly short crisp hair of the Negro, for instance, is well differentiated from the hair of any European race; the straight lank hair of most aborigines is much coarser than hair of similar straightness occurring in more civilised races. Information derived from mere similarity of the way in which whiskers, beard, and moustache are worn is of very little value without strong corroborative evidence.

Length. This gives nothing more than a suggestion in a case of an unknown person. A man may let his hair grow, and at the present time a great many women wear their hair short. It may be of some little importance to determine whether the hair in question has its natural length, or whether it has been artificially shortened by cutting; the microscope will easily detect the difference. If of natural length it *may* be possible to suggest its origin—eyebrow, scalp, pubes, etc.

Distribution. The distribution of the hair may be of a certain importance in identification. For example, a quantity of hair in the beard region, hair in the ears, nose and anus, profuse hairiness of the torso, are all suggestions of the male. The distribution of pubic hair differs in the two sexes, in the male the hair tends to run in a triangular manner to the umbilicus, in the female it usually terminates along a line joining the iliac spines. In suprarenal virilism in females hair may be found growing profusely in masculine sites.

Can the Hair Grow after Death ? It may be accepted as a fact that growth of the hair after death does not take place. The skin shrinks after death, and hence a man who had been shaved just previous to death might in twenty-four hours appear not to have been shaved, but beyond this there is nothing to be said.

HAIR AS A FACTOR IN CRIMINAL EVIDENCE

In this connection hair may assume a position of overwhelming importance. The questions that a medical witness must be prepared to try to answer are—(1) Is the object submitted for examination hair or some other substance ? (2) If hair, is it human or from some other animal ? (3) If human, from what part of the body did it come ? (4) Is it the hair of a certain person ?

1. **Is this Hair or something else ?** In examining any blood clot or small mass of mud from boots or articles of like nature, the substance must be digested and broken up in water, so that any possible fibres may be separated. If a boot or any weapon is submitted for examination, it must be scrutinised closely by the naked eye and with a lens, especially in any of the unevennesses in general contour, such as the junction of haft and blade, notches on the blade, cracks in boot nails, junction of nail with leather, hooks or lace holes, etc., etc. Any fibres must be carefully extracted by forceps or by maceration in water and submitted to microscopical observation. A precise and detailed examination of the cuticular scale pattern, the cortex and medulla must be made of the whole length of the hair, and of both extremities. It may also be necessary to make a cross section of the shaft. If only one hair is available it must be kept in its natural state for comparison with other hairs should this be required at a later period.

The substance of a hair is mainly composed of a pigmented horny fibrous material known as the cortex which can be separated by the action of sulphuric acid into long tapering fibrillated cells, the nuclei of which may be still visible. Most of the pigment of the hair is found in this layer. This fibrous substance of the hair is covered by a layer of delicate imbricated scales termed the hair cuticle, the form of which is of great value in identification. In many hairs, but not in all, the centre is occupied by a medulla which may present features of a certain value in identification from its size, relation to the cortex and the shape and size of its cells. There is little pigment in the medulla but the presence of air gives the appearance of colour. The root has the same structure as the body of the hair except at its extremity, which is enlarged into a knob composed mainly of soft growing cells, fitting over a vascular papilla which projects upwards from the bottom of the follicle.

The substances which are likely, to the naked eye, to be mistaken for hairs are fibres of the common stuffs for clothing—cotton, hemp, silk, and wool. When examined under similar powers of the microscope to those suggested for hair, cotton presents itself as a flattened band, assuming more or less a spiral form (Fig. 9). The fibre of linen derived from flax is of a rectilinear form, with jointed markings at unequal distances, the fibre tapering to a point (Fig. 10). Silk being the dried secretion of a gland presents a regular cylindrical form (Fig. 11), and there are no markings upon the surface. It has a strong refracting power on light, which gives to the fibre a well-defined boundary. The fibre of wool is irregular, contorted, of unequal thickness, and it has peculiar markings of an imbricated character on the surface (Fig. 12). The microscopical characters of these fibres under certain circumstances are long retained, so that they may be identified after many centuries. Fig. 13 represents the woollen fibre from the shroud of a monk buried in an ancient priory in the fourteenth century, and exhumed after the lapse of five hundred years. The markings are less defined than in a recent sample of wool, and the fibres are of a coarser and larger kind. The fibre of linen appears to be equally indestructible. Fig. 14 represents fibres from the linen cerements of a mummy, of the dynasty of the Shepherd Kings. It was unrolled in 1832. This fibre was well preserved and was still tough. The

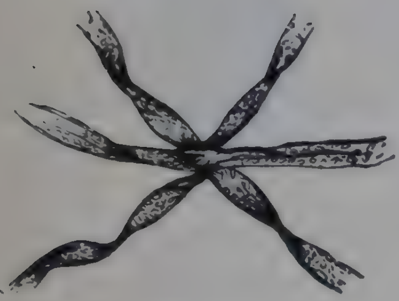

FIG. 9.
Fibres of cotton, magnified 300 diameters.

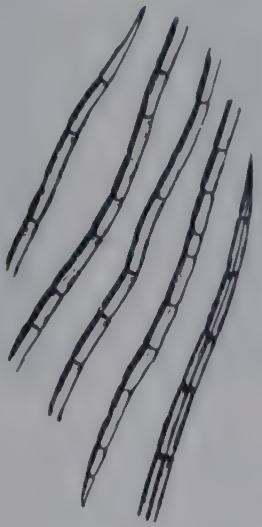

FIG. 10.
Fibres of linen, magnified 300 diameters.

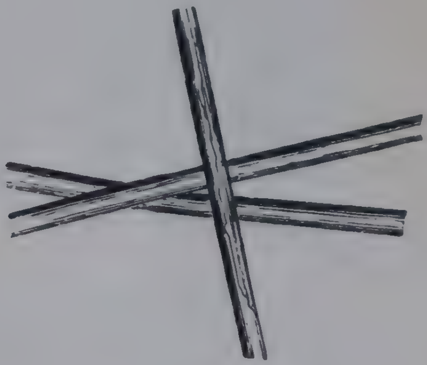

FIG. 11.
Fibres of silk, magnified 300 diameters.

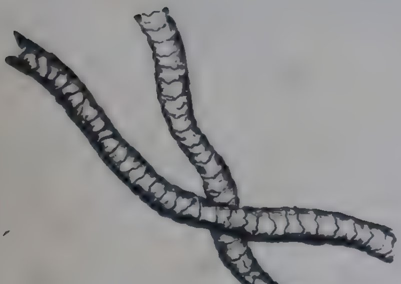

FIG. 12.
Fibres of wool, magnified 300 diameters.

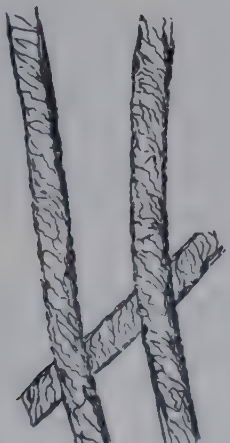

FIG. 13.
Fibres of ancient wool, magnified 300 diameters.

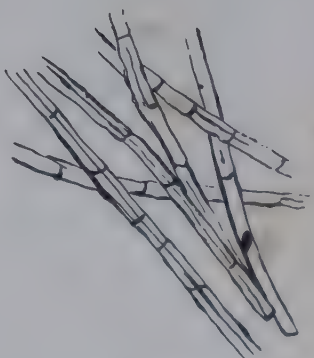

FIG. 14.
Fibres of ancient linen from an Egyptian mummy, magnified 300 diameters.

ancient wool was rotten, and broke into small fragments. The linen had the characters of the fibre of modern flax. It was of a very coarse fabric, and was strongly impregnated with a brown bituminous matter used in embalming. Its preservation was no doubt in great part owing to the presence of this substance. These illustrations have been drawn from average specimens, under the same power of the microscope, so that they are calculated to give an idea of the relative size of the fibres.

Other fibres are frequently found upon weapons, boots, and articles of dress. These are common vegetable fibres from roots, leaves and other substances. They cannot be confounded either with hair or with the fibres described above, but any fibre of whatever nature found in connection with a crime may be of some importance for comparison with other fibres and should be the subject of careful and detailed examination.

If it is Hair, is it Human Hair? The hairs of animals are frequently found on weapons and clothing; they must not be confounded with human hair. They are, generally speaking, coarser and thicker and have a wider medulla than those of a human being, but it is extremely dangerous to give an opinion about the nature of a hair without a careful microscopic examination and after comparison with other known samples of hair.

A decision about the nature of a hair can be arrived at only after a detailed examination of the cuticular scale pattern, its cortex and medulla, its form and size, and the relative size of its component parts as seen in longitudinal plane and cross section.

The cuticular scales vary in shape and size in different species of animals, and are of considerable value in identification. They vary considerably, however, in different part of the same hair and may differ considerably in the wool and coat hair of the same animal.

These scales may be readily observed on examination in the dry state providing the hair is not too deeply pigmented. A convenient method of studying the scale pattern is by means of a cast. A thin film of cellulose acetate conveniently purchased as nail varnish is made on a microscope slide in the manner in which a blood film is made. The hair, previously cleaned by immersion in a mixture of alcohol and ether, is placed on the wet film and allowed to remain for about ten minutes. The hair is then stripped from the film leaving an excellent impression of the scale structure which is best viewed by oblique light. The hair is unharmed by this procedure.

The major types of scales may be classified into seven groups shown in Fig. 15, of which type seven is typically human; the presence of this type of hair scale, however, does not enable us to assign the hair to a human origin but the presence of any type other than this definitely excludes a human origin, except in the case of newly-born infants in which type six is often found.

In the examination of the cortex and medulla, the hair if pigmented must be bleached and Davidson and Taylor [1] consider that a great deal of the apparent colour is due to air in the medulla which can be removed by exposure in a vacuum oven.

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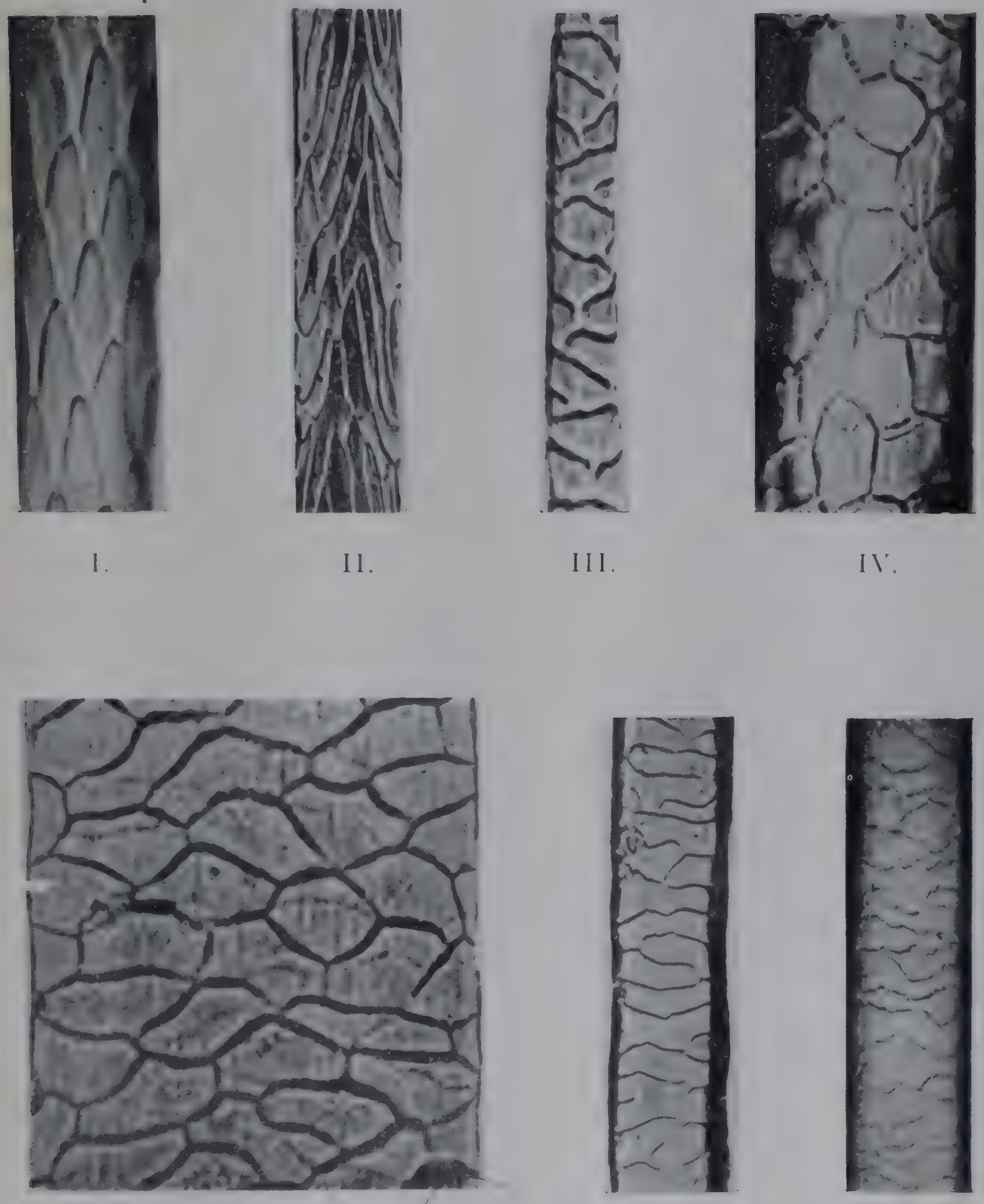
[1] *Journ. Quekett Micros. Club.*, Series 4, Vol. 1, No. 6, December 1943.



I. II. III. IV.

V. VI. VII.

Fig. 15. Major cuticular scale types of Mammalian Hair. Magnified 200 diameters. (Moritz.)

To face page 122.

In general the cortical layer in human hair is relatively broad and the medulla relatively narrow. It is in general narrower than in other animal hairs.

The medulla may be continuous, interrupted or apparently absent altogether.

The cortex is striated longitudinally and such pigment as there is is found in this layer towards the cuticular surface and is best seen in cross section.[1] Davidson suggests the following staining technique for the examination of all three parts of a hair.

(1) Cut root and tip off hair.
(2) Place hair in equal parts of absolute alcohol and ether (cleansing and fat-solvent reagents) 15 min.
(3) Wash well in distilled water.
(4) Place in distilled water in vacuum embedding oven and exhaust at room temperature, maintaining a pressure of 18-30 mm. mercury 2 hr.
(5) Bleach in the following solution :
    90 vol. hydrogen peroxide diluted 1 in 3 with distilled water 50 ml.
    5% aqueous ferric chloride 1 drop
    Excess of liq. ammonia added immediately before use 15 min.-12 hr.
(6) Wash well in distilled water.
(7) Stain in 1-100 carbol fuchsin (Ziehl Neelsen) in distilled water in vacuum embedding oven at room temperature and at pressure of 18-30 mm. of mercury at least 15 min.
(8) Wash in distilled water.
(9) Decolorize and dehydrate in absolute alcohol 5-10 min.
(10) Clear in benzene and mount in Canada balsam.

A hair so prepared gives three optical sections on examination, viz. : (*a*) cuticular scales on upper surface of hair, (*b*) cuticle, cortex and cellular structure of the medulla, (*c*) cuticular scales on under-surface of hair.

Therefore in one preparation the cuticular scales in detail and the longitudinal section of the hair can be studied.

The above examination may enable the observer to diagnose the origin of a hair, or at least the group of animals from which a hair has been derived, but it is never possible to state that a hair belongs to a particular individual or animal. No one is entitled to say more than that the hair appears to be identical in all aspects with the hair from a particular source.

If Human, from what Part of the Body did it come ? Comparison with hairs of known situation is essential. It is of no use whatever to state that the hair of the eyebrow and eyelash is stouter than that of the head, nor that the hair of the pubes and axillæ is stouter than that on the rest of the body. Stoutness is entirely a matter of comparison.

In examining hairs microscopically it will be well to observe whether they are of the same or of different colours or sizes, whether they are pointed at one end or cut at both ends, and whether they have still attached to them the bulb or sheath in which they grew. This condition of the hair will be found when it has been violently torn from the skin. Hairs which have not been cut are pointed at their free extremity unless they are taken from a locality where there is constant friction, such as the axilla or pubis, in which case they frequently show a brush-like appearance. The microscope will sometimes enable a medical jurist to state whether a hair has been indented, cut, or bruised, at either or both ends ; the medullary structure frequently retains these marks of violent treatment. A spermatozoon or other body might possibly be found adhering to a hair. All these matters may help in deciding where a hair came from ; the seat of a blow might, for instance, be known, and a hair on a blunt weapon when compared with another from the same seat of injury may show similarity or not. But without such points of comparison it would be foolish to swear to the locality from which a hair came.

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[1] For details of examination of hairs see Sydney Smith & Glaister "Recent Advances in Forensic Medicine."

The following cases illustrate the above matters :

In the Crippen case some hairs found on a hair curler associated with the mutilated remains were shewn to be partially bleached and corresponded with the bleached hair of the alleged victim Belle Elmore.

In the Podmore case (Southampton, 1928), hairs found on a hammer were identified as hairs from the eyebrows of the victim.

In *Rex* v. *May* (Reading Assizes, 1926) it was shewn that hairs on the coat of the accused were similar in character to the hairs of Shorthorn cattle from the herd from which animals were maimed.

In *H.M. Advocate* v. *Donald*, High Court of Justiciary, Edinburgh, 1934, hairs found in a sack containing the dead body of a child were found to be identical with hairs of the accused woman.

In *R.* v. *Hansen* the weapon by which the deceased lost his life was a heavy stone found near the dead body. The base of the skull was fractured, and there were upon the stone marks of blood with some hair similar to that of the deceased. The prisoner was connected with the act by his having been seen with the stone, or one closely resembling it, in his possession. On these and other circumstances he was convicted.

In *R.* v. *Teague* it was alleged that the fatal wounds to the head of the deceased, involving both eyebrows, had been produced by a hammer found in a hedge. There was no blood on the hammer, but there were two short white stiff hairs at the smaller end. It was suggested that these might have been the hairs of a white goat, the hammer having been used for beating out portions of goat-skin which were hanging on the same hedge. Two medical witnesses, however, deposed that they were hairs from a human eyebrow, and having compared them with deceased's eyebrows, they found they agreed. The hair of the eyebrow was described as conoidal or pyramidal ; and the hair on the hammer had this character. It appeared as if it had been bruised or squeezed between two blunt substances, but this appearance might have been equally presented on the theory of the defence that it was goats' and not human hair. The medical evidence pointed to the weapon, and not to any act on the part of the prisoner. The witnesses were severely cross-examined upon the structural differences of the hair of man and animals.

A hatchet, having clotted blood and hair adherent to it, was produced as evidence against an accused person, under whose bed this weapon had been found. This, with other circumstantial evidence, had turned public opinion strongly against the prisoner ; but when the hair was examined it was found not to be human, but to have originated from the body of some animal. It turned out that the accused had killed an animal with the hatchet, and had carelessly thrown the weapon under the bed ; the accused was acquitted.

In *R.* v. *Watson and Wife* the prisoners were charged with the murder of a man named Raynor. He was seen going into the prisoners' house and about two hours afterwards his dead body was found lying across a line of railway below it. The medical evidence showed that death had been caused by manual strangulation. No hat could be found. There were marks of dragging between the cottage and the line of railway, and at one part in the soft clay there were the impressions of footmarks corresponding to the boots of the male prisoner. On searching the house an iron rake was found concealed on a shelf, with a cindery substance adhering to one end of it, looking as if it had undergone fusion. On heating a portion of it the smell of burnt shellac was emitted, and on acting on it with alcohol a resinous solution like that of shellac was obtained. The alcohol caused the separation of some fibres which under the microscope proved to be the hair of some rodent animal. On being questioned respecting the rake the male prisoner said he himself had used it on the Friday (the day before the murder) for cleaning out a cesspool.

A hat similar to that worn by the deceased. and purchased at the same shop, was burnt. The cindery ash was collected, and submitted to examination. These hats are made of felt, chiefly from rabbits' and hares' fur and this is mixed with shellac.

The theory of the prosecution was that deceased had been killed by the prisoners in their house ; that they had afterwards taken an opportunity of dragging the dead body from the cottage to the railway, and had laid it across the rail, with a view of its being run over by an expected train and concealing the murder. The train then due was late that day, and the body was discovered and removed by the porter before it had passed. Where was the hat of the deceased ? It was a worthless article, which no one perpetrating murder would have stolen, to be perhaps a proof against him, and yet no hat was found with the body. It was suggested for the prosecution that in dragging down the body the hat was accidentally left in the cottage. To have returned with it to the railway might have led to detection. It was assumed that the prisoners had burnt it under the grate in order that it might not be evidence against them, and that they used the rake in the process by pressing it together, and thus some portion of the half-burnt felt still adhered to the flat end of the rake.

It was suggested in the defence that the rake might have been used for the burning of a hat a long time previously, and that the burnt shellac or resin adhering to the rake might have been used by somebody for making varnish. According to the statement of one of the prisoners, the substance found on the rake could not have been there more than twenty-four hours, *i.e.*, within the time which included the murder of Raynor. Admitting that shellac or resin is used in making varnish, rabbits' fur is not so employed, and it was necessary to account for the presence of both these substances on the rake. There was no evidence to show that there had been varnish-making and the burning of rabbit-skins in this cottage within twenty-four hours of the death of Raynor. The only conclusion to be drawn from the facts was that some one for some purpose or other had within the time mentioned burnt in the prisoners' cottage a hat similar to that worn by the deceased, and that the prisoners knew nothing of the proceeding.

Age

The establishment of the age of an individual has so many medico-legal bearings that it must be fully discussed, after which we may consider the questions that may arise. Inasmuch as even the age of the earliest embryo may have a bearing on the chastity of a woman, it is necessary to commence at the time at which an embryo can be distinguished, although the early products of conception have more connection with evidences of pregnancy and abortion than with identity.

It is convenient to discuss the evidences of age in periods :

1. The age of an embryo up to six months.
2. The age of a fœtus between six months' intra-uterine life and full term.
3. The age of a child recently born.
4. The age of a child which has survived birth more than a day or two, or of an adult.

Age of Embryo up to Six Months

" *First Month.* At the end of the third week the diameter of an ovum is two-thirds of an inch, the length of the embryo one-sixth of an inch ; the amnion is formed; the embryo's back is curved, and the enlargement of its cephalic extremity marked. At the end of the fourth week the greatest diameter of the ovum is about seven-eights of an inch, its weight about forty grains; the length of the embryo is about one-third of an inch; the eyes, the ears, and the visceral arches are distinguishable. Four bud-like processes mark the commencement of the limbs. The umbilical vesicle is manifest, but smaller than the embryo. The amnion is not much distended and separated by an interval from the chorion.

"*Second Month.* At the end of the second month the ovum is about one inch and three-quarters in its greatest diameter, and the embryo three-quarters of an inch long. The umbilical vesicle is very small, and hangs by a withered thread. The limbs are more manifest, the hand has a human appearance. Points of ossification have appeared in the lower jaw and clavicle. The mouth and nose are manifest. The Wolffian bodies have atrophied, and the kidneys have appeared.

"*Third Month.* At the end of the third month the ovum is about four inches long, the placenta is formed, and the rest of the chorion has a considerable extent lost its villosity. The chord has now become long relatively to the foetus, and already shows its spiral twist. The foetus is four to four and a half inches long, and weighs about 450 grains. The head is separated from the body by the neck, and the oral from the nasal cavity by the palate, and the mouth is closed by the lips. The sexual organs have appeared, but the penis and clitoris are scarcely distinguishable. The limbs are developed, including the fingers and toes, and a first appearance of formation of nails can be detected. Points of ossification have appeared in most of the bones.

"*Fourth Month.* At the end of the fourth month the foetus is, on an average about six inches long, and weighs about three ounces. The sex can now be distinctly recognised. The bones of the skull have partly ossified, but still have a very wide fontanelles and sutures. There is a slight commencement of the formation of down on the skin. *Movements of the limbs have commenced; but these may, however, be detected in a freshly expelled embryo even before the end of the third month.*

"*Fifth Month.* The foetus is, on an average, nine inches long, and weighs nearly eleven ounces. Hair has appeared upon the head, and lanugo or down over the whole body. The skin begins to be covered with vernix caseosa. There is a centre of ossification in the os calcis.

"*Sixth Month.* The foetus is, on an average, about twelve inches long, and weighs about twenty-four ounces. The eyebrows and eyelashes are beginning to form. Subcutaneous fat is commencing to be deposited, but only in small degree, so that the skin is still wrinkled. There is a yellowish material in the small intestine, and there may be a commencing appearance of the darker meconium in the large intestine. The hair on the head is longer and less like down."

For further particulars the reader is referred to special works on embryology.[1]

With reference to the terms here employed, the "ovum" signifies the embryo *and* its membranous coverings; the "embryo" is the body which is afterwards converted into the fœtus; "fœtus" is the name applied to the embryo after the third month of gestation.

The great difficulty consists in determining the nature of the supposed ovum or embryo in the first two months. In making the examination the material should be placed in a dish of water, and all coagula gently washed away or removed by some blunt instrument. If the embryo cannot be found, the decidua and chorion, or portions of them, may be recognised, the former by its forming the outer investment, with its smooth internal and rough external or uterine surface, the latter by its villous or shaggy appearance. Between the third and fourth months the fœtus may be commonly identified without much difficulty. The ovum in many instances escapes first, leaving the decidua behind. When a semi-decomposed or dried mass of blood clot, etc., is presented for examination, it is often convenient to take an X-ray plate of the specimen. If the fœtus is about the third month onwards the ossified ribs and limb bones will be seen. It is important to remember that, in some states of the virgin, decidua-like structures are shed from the uterine mucous membrane which, when examined by the microscope, are like the true decidua. Both are constituted of the innermost portion of the uterine mucous membrane, and contain all its elements. *It requires a skilled microscopist to distinguish placental tissue with certainty.* Evidence of this nature formed the basis of the libel action *Kitson* v. *Playfair*, in which Dr. Playfair threw doubts on the chastity of the plaintiff.

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[1] See Keith's "Human Embryology."

Such are the principal points we have for determining the age of the contents of the uterus in the early stages of pregnancy.

The points themselves are of such a nature that, while it is easy to decide between extremes, it is quite impossible to draw hard and fast lines between say the second and third months and between the third and fourth ; and these are precisely the cases in which lawyers will attempt, in defence of a woman's chastity, to obtain an opinion when, for instance, the last possible date of connection is five months, and a fœtus is born which might be of three, four, or five months' development. The great variability in development renders it essential for the medical witness to fix reasonably wide limits and leave the decision to other evidence and to the jury.

With regard to the question of live birth in such immature fœtuses, *vide* "Live Birth," Vol. II.

AGE BETWEEN SIX MONTHS AND FULL TERM, NINE CALENDAR MONTHS

The following description of the child between six and nine months corresponds very closely with those in most text-books on midwifery :

> "*Between the sixth and seventh Months.* The child measures, from the vertex to the sole of the foot, from ten to twelve inches, and weighs from one to three pounds. The head is large in proportion to the trunk ; the eyelids are adherent, and the pupils are closed by membranes (membranæ pupillares). The skin is of a reddish colour, and the nails are slightly formed ; the hair loses the silvery lustre which it previously possessed, and becomes darker. Ossification proceeds rapidly in the chest bone, and in the bones of the foot. The os calcis or calcaneus shows a well-ossified centre. The brain continues smooth on its surface, and there is no appearance of convolutions. In the male the testicles will be found in the abdominal cavity, lying upon the psoas muscles immediately below the kidneys.
>
> "*Between the seventh and eighth Months.* The child measures between thirteen and fourteen inches in length, and weighs from three to four pounds. The skin is thick, of a more decidedly fibrous structure, and covered with a white unctuous matter (vernix caseosa) which now first appears. Fat is deposited in the cellular tissues, whereby the body becomes round and plump ; the skin previously to this is of a reddish colour, and commonly more or less shrivelled ; the nails, which are somewhat firm, do not quite reach to the extremities of the fingers, the hair becomes long, thick, and coloured ; ossification advances throughout the skeleton ; the astragalus (or talus) shows an area of ossification ; valvulæ conniventes appear in the small intestines ; and meconium is found occupying the cæcum and colon. The testicles in the male are considered about this period to commence their descent, towards the scrotum. The time at which these organs change their situation is probably subject to variation. The testicles are situated in the abdomen at the seventh, and in the scrotum at the ninth, month ; at the eighth month they will commonly be found in the inguinal canals. At different periods between the fifth and sixth months of fœtal existence, or sometimes even later, the testicle begins to move

from its situation near the kidney towards the internal abdominal ring, which it usually reaches about the *seventh* month. Its absence from the scrotum at birth does not necessarily indicate that the child is immature, because the organ sometimes does not reach the scrotum until after birth, and sometimes not at all (*vide* 'Cryptorchism,' Vol. II.).

" *Between the eighth and nine Months.* The child is from fifteen to sixteen inches in length, and weighs from four to five pounds. The eyelids are no longer adherent, and the membranæ pupillares have disappeared. The quantity of fat deposited beneath the skin is increased, and the hair and nails are well developed. The surface of the brain is grooved or fissured but presents no regular convolutions. The meconium occupies almost entirely the large intestines ; and the gall-bladder contains some traces of a liquid resembling bile. The testicles in the male may be found occupying some part of the inguinal canal, or they may be in the scrotum. The left testicle is sometimes in the scrotum, while the right is situated about the external ring. A centre of ossification appears in the lower epiphysis of the femur.

" *Ninth Month : Signs of Maturity.* At the ninth month the average length of the body is about eighteen inches, and its weight from six to seven pounds. The male child is generally rather longer, and weighs rather more than the female. Extraordinary deviations in length and weight are occasionally met with. Galabin states that children are sometimes born mature and survive which weigh less than five pounds. On the other hand, Dr. Waller,[1] records the birth of a child weighing 18 lbs. 15 ozs., while lengths of twenty-four and thirty-two inches are also recorded. According to Duncan, the length and weight of the child vary according to the age of the mother. They are greatest when the mother is from twenty-five to twenty-nine years of age."

By the end of the ninth month the centre of ossification in the lower epiphysis of the femur measures about a quarter of an inch in diameter. Great stress is placed on the presence of this point of ossification in the lower epiphysis of the thigh-bone (femur) in its bearings upon the maturity of the fœtus. This point usually first makes its appearance at the 36-37th week ; at the 37–38th week it is commonly the size of the head of a house-fly ; and at the full period it is of one-fourth to one-third of an inch in diameter. When this point of ossification is one-third of an inch in diameter, it may be confidently affirmed that the fœtus has reached the full period, but the size of the centre is subject to variation. A centre or ossification is frequently found in the head of the tibia and one in the cuboid bone of the foot in full-term well-developed children.

At the full period the head of a child is large, and forms nearly one-fourth of the whole length of the body. The cellular tissue is filled with fat, so as to give considerable plumpness to the whole form, while the limbs are firm, hard and rounded ; the skin is pale ; the hair is thick, long, and somewhat abundant ; the nails are fully developed, and reach to the ends of the fingers—an appearance, however, which may be sometimes simulated in a premature child by the shrinking of the skin after death. Ossification will be found to have advanced considerably throughout the skeleton. The surface of the brain presents convolutions, and the grey matter begins to show itself.

The characters given at the different stages of gestation must be regarded as representing an average statement. They are, it is well known, open to numerous exceptions. Twins are generally smaller and less developed than single children ; the average weight of a twin child is not more than five pounds, and very often below this. The safest rule to follow in endeavouring to determine the intra-uterine age of a child is to rely upon a majority of the characters which it presents. That child only can be regarded as *mature* which presents the greater number of the characters found at the ninth month of gestation.

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[1] Obstretical transactions.

It is convenient to remember that the length of the child in inches is, during the later stages of pregnancy, about double the intra-uterine age in months.

Conclusions. The following table may be taken as a summary of the principal facts upon which our opinion respecting the uterine age of a child may be based :—

	6 months.	*7 months.*	*8 months.*	*9 months.*
Length . .	9 to 13 ins.	12 to 15 ins.	15 to 17 ins.	18 to 20 ins.
Weight . .	1 to 2 lbs.	2 to 4 lbs.	4 to 5 lbs.	5 to 8 lbs.
Skin . .	Red and wrinkled.	Paler and smoother.	Paler.	
Fat . .	No subcutaneous fat.	Fat beginning to be deposited.	Child plump.	
Scrotum. .	Empty.	—	Corrugated.	Occupied by testes.
Testes . .	On psoas muscle.	Near the internal ring.	In canal.	In scrotum.
Sex . .	Well differentiated.			
Hair . .	Lanugo and vernix caseosa.	Scalp hairy with lanugo.	—	Hair on scalp an inch long.
Eyelids . .	Adherent.	Non-adherent.	Well formed.	
Brain . .	Sylvian fissure formed.			
Intestine .	Meconium in small intestine.	Meconium in large intestine.		
Centres of ossification.	Manubrium and os calcis.	Astragalus.		Lower epiphysis of femur. Cuboid, upper epiphysis of tibia.

THE AGE OF A CHILD RECENTLY BORN

We have now to deal with a different class of age data from those we have hitherto considered. These have been entirely directed to proving either that a child could or could not have been the child of particular parentage or that it was or was not capable of extra-uterine life. We have now to consider for how long it has lived, and we assume that there is definite evidence of some duration of life. Under " Infanticide " will be found all there is to be said upon evidence bearing upon this assumption.

Changes in the Lungs, whether of the nature of atelectasis or of full respiration, and changes in the fœtal circulation will not be of much assistance, though they may be of great importance in deciding whether the child was born alive (see " Live Birth "). We have mainly to rely upon changes in the umbilical cord and changes in weight and stature in endeavouring to determine the age of a new-born child, and it must be admitted that none of them yields very decisive indications.

Changes in the Umbilical Cord. These are certainly the least untrustworthy of any data we have, for the changes are due to vital processes.

and are governed by laws which are fairly well known, and which pursue a fairly regular course. Thus when the cord is tied and severed in the usual way the portion left adherent to the body begins to dry up in from twelve to twenty-four hours, and in about twenty-four hours from birth a ring of inflammation makes its appearance round the site of its insertion. This inflammatory redness must not be mistaken for the thin red circle which is almost constantly present at birth. About the third or fourth day the drying of the cord is complete, and the dried portion separates from the navel about the fourth or fifth day, leaving an ulcer which takes from seven to twelve days to heal completely. Hence if a child is found with well-marked inflammation or an ulcer at the umbilicus a very reasonable approximation may be made to the time that it lived after birth, though even here the different rates at which wounds heal in healthy and unhealthy children must render the judgment somewhat tentative

It was formerly stated that if a child had lived two or three days, long enough, that is, for the cord appreciably to mummify, no amount of soaking in water would cause a *restitutio ad integrum* in the dried parts, but this statement is much too positive. A dried cord swells up, and, except that it may be a little darker, it is difficult to distinguish from a cord which has not become dry before soaking (*vide* " Infanticide "). Children's bodies at this age are frequently thrown into water, and in bodies thus recovered a dried piece of cord suggests two or three days' exposure to air before immersion.

Weight. If we consider the extreme limits for the weights of new-born children and then remember that we have no means of knowing what the weight of a child was at birth, it will be seen that the absolute weight of a child found dead if of no use in estimating how long it lived if it is probable from other reasons that it was not more than a few days old.

Height. Precisely the same reasoning applies to the length of a new-born child. The extremes are too variable, and therefore the initial basis for comparison is not available (see " Prolonged Gestation ").

The following may be taken as a summary of the appearances observable in the body of a child that has survived its birth for the undermentioned periods :—

1. *After twenty-four hours.* The skin is firm and less red than soon after birth. The umbilical cord is somewhat shrivelled, although it remains soft and bluish-coloured from the point where it is secured by a ligature to its insertion in the skin of the abdomen. The meconium may be discharged, but a green-coloured mucus is found in the large intestines. The lungs may be more or less distended with air, although in one case of survival for a period longer than this no trace of air was found in them. With regard to the state of the lungs, it should be remembered that when these organs are fully and perfectly distended the inference is that the child has probably survived some hours ; but the converse of this proposition is not always correct. Several reported cases show that when the lungs contain a small quantity of air it does not follow that the child must have died immediately after it was born.

2. *From the second to the third day.* The skin has a yellowish tinge ; the cuticle sometimes appears cracked, a change which precedes its separation in scales. The umbilical cord is brown and dry between the ligature and the abdomen.

3. *From the third to the fourth day.* The skin is more yellow, and there is an evident separation of the cuticle from the skin of the chest and abdomen. The umbilical cord is of a brownish-red colour, flattened, semi-transparent, and twisted. The skin in contact with the dried portion presents a ring of vascularity or redness, gradually shaded off towards the abdomen. Geoghegan met with this appearance in two cases of still-born children, and Taylor saw it in four cases in which the children were born dead. The colon is free from any traces of green mucus.

4. *From the fourth to the sixth day.* The cuticle in various parts of the body is found separating in the form of minute scales or of a fine powder. The umbilical cord separates from the abdomen usually about the *fifth day*, but sometimes not until the eighth or tenth day. If the umbilical aperture is cicatrised and *healed*, it is probable that the child has lived for three weeks to a month after birth. The ductus arteriosus may be found contracted both in length and diameter; the foramen ovale may be also partly closed.

5. *From the sixth to the twelfth day.* The cuticle will be found separating from the skin of the limbs. If the umbilical cord was small, cicatrisation will have taken place before the tenth day after birth; if large, a sero-purulent discharge will sometimes continue to escape from it for twenty-five or thirty days. The ductus arteriosus is said to become entirely closed during this period; but this statement is open to exceptions, which are elsewhere pointed out. The body rapidly increases in size and weight when the child has enjoyed active existence and adequate feeding.

On the whole, it will be seen that the signs of survivorship for short periods after birth are not very distinct, and it is in some respects fortunate that great precision in assigning the time of survivorship is rarely demanded of medical witnesses.

It is expected that a medical man will be able to distinguish between a new-born child and one which has been born for several days, and evidence on this subject is occasionally required in reference to supposititious children. Those who attempt a fraud of this kind have sometimes been compelled to substitute a child two or three days old for one just born. A medical man called in to a woman after an alleged delivery in the presence of a nurse (perhaps an accomplice) is bound to exercise great caution. In the event of litigation at a subsequent date, he is expected to be able to inform a court of the condition of the child when first seen by him and of the probable date of its birth. He will not be allowed to throw the blame of a mistake upon others. The success or failure in perpetrating a fraud of this kind will depend upon his observation of the facts.

A medical man cannot be too careful in noticing upon the body of the child any characters which may serve as proofs of identity. He must remember that the defence may be that the child is not that of the woman charged with murder. This observation applies especially to the examination of the bodies of children who have survived their birth for some days. The body may be found wrapped in paper, or in some article of clothing which may help to establish identity. If the child has survived its birth, it is advisable to make an estimate of the number of days elapsing since birth. In addition, the sex of the child and the colour of the hair should be noted, as well as any particular marks on the skin, and, of course, all wounds or injuries, their situation, and any indication of their cause or mode of production.

R. v. *Ward* was a case of some difficulty respecting the identity of a child alleged to have been murdered. The dead body of a child which had survived its birth was found wrapped in clothing, and concealed near a high-road, by which the woman charged with murder had been seen to pass on a certain day. The surgeon who examined the body thought that, from its state, the child had been dead a month, but he was unable to give any opinion about the cause of death. The child of the accused had disappeared when it was about a fortnight old.

The defence was that the child whose body was found was not that of the accused. The child found, as well as that of the woman, was of the male sex, and had light hair ; but the age caused a difficulty. The child of the accused must have been at least fifteen days old at the time of its death while the surgeon considered that the body found was that of a child not more than ten days old. Upon this evidence the accused was acquitted.

This case serves as a warning of the legitimate limits of medical evidence. When the body of a child has been lying putrefying for a month, and has so far decomposed that the cause of death cannot be estimated, it is difficult to suppose that it could yield evidence of so fine a point as whether it were ten or fifteen days old.

Estimation of Age in a Child which has survived Birth for a Longer Period

In the absence of documentary proof, the estimation of the age of a *living* child can be only approximate until it arrives at the time when dentition commences. The height and weight may afford some little assistance, but it must be remembered that there is a tremendous difference in the rapidity of growth not only in children of a different sex, but also in those of the same sex, and not only in single births, but even in the case of twins. One may flourish and grow while the other remains puny. The average that is ordinarily expected is that a child should measure about two feet high by the end of the first year, and should weigh about twenty pounds, with proportionate increase from birth upwards.

The following table gives the average monthly weights of children during the first year of life :—

	lb.	oz.		lb.	oz.
At birth	6	8	7 months	13	4
1 month	7	4	8 ,,	14	4
2 months	8	4	9 ,,	15	8
3 ,,	9	6	10 ,,	16	8
4 ,,	10	8	11 ,,	17	8
5 ,,	11	8	12 ,,	18	8
6 ,,	12	4			

Age from One Year to Puberty

When the teeth commence to erupt they form the most reliable means for the estimation of the age of a child from about the age of six months to puberty, whether the child be living or dead ; it is possible by X-ray examination to corroborate such evidence from the ossification of the bones, for which purpose a table is here inserted of the principal points in such ossification. The figures must not be taken too rigidly, but only as implying an average.

APPEARANCE OF POINTS OF OSSIFICATION

	Foot.	*Hand.*
5th–6th month, intra-uterine.	Os calcis (body).	Whole hand cartilaginous during intra-uterine life.
7th ,, ,,	Astragalus.	
9th ,, ,,	Cuboid.	
1st year, extra-uterine	External cuneiform (1–2).	Os magnum and unciform.
3rd ,, ,,	Internal cuneiform.	Cuneiform (2–3).
4th ,, ,,	Mid cuneiform.	Semilunar (4-5).
5th ,, ,,	Scaphoid (4–5).	Trapezium (5-6).
6th ,, ,,		Scaphoid
8th ,, ,,		Trapezoid (6–7).
10th ,, ,,	Os calcis, epiphysis of.	
11th ,, ,,		Pisiform.

APPEARANCE OF OTHER POINTS OF OSSIFICATION

1st year	Heads of humerus, femur, and tibia.
2nd ,,	Lower ends of radius, tibia, and fibula.
3rd ,,	Patella.
4th ,,	Upper end of fibula, great trochanter of femur (4-5).
5th ,,	Lower end of fibula.
6th ,,	Head of radius. Lower end of ulna.
10th ,,	Upper end of ulna (olecranon).
11th ,,	Trochlea of humerus. Lesser trochanter of femur.
13th–14th ,,	External condyle of humerus.

UNION OF BONES AND EPIPHYSES

By 1½	years	the anterior fontanelles should be closed.
,, 9	,,	the ilium, pubes, and ischium should meet in the acetabulum.
,, 13	,,	these three should be united but still separable on maceration.
,, 15	,,	the coracoid should be united to the scapula.
,, 16	,,	the olecranon should be united to the ulna.
,, 16–17	,,	the head of the radius and the lower end of the humerus should be joined to their respective shafts.
,, 17-18	,,	the internal epicondyle should be united to the humerus.
,, 18–20	,,	the head of the femur should have joined the diaphysis.
,, ,,	,,	the epiphyses of the long bones of hand and foot should have united to the diaphyses.
,, 20	,,	the epiphyses of the fibula should be united to the diaphysis.
,, 25	,,	the epiphysis at the sternal end of the clavicle, the crest of the ilium and the articular facets of the ribs should be united.

If all the epiphyses are found united, the individual is almost certainly over twenty-five years of age, and if the three parts of the sternum are united by bone he is almost certainly thirty-five or over.

As stated above, these points can be investigated with almost the same accuracy in the living as in the dead by means of X-rays.

Height and weight are too variable to be of much use, but the following table shows the averages with which a given individual may be compared.[1]

Age last Birthday	Males.			Age last Birthday	Females.		
	No.	Height.	Weight.		No.	Height.	Weight.
		cm.	kilos.			cm.	kilos.
3	9,388	92.4	14.86	3	8,478	91.6	14.44
4	24,047	98.2	16.29	4	21,362	98.1	15.82
5	65,438	103.0	17.54	5	63,825	102.6	17.07
6	20,554	108.0	19.33	6	21,238	107.6	18.58
7	37,515	114.7	21.20	7	36,477	113.9	20 50
8	9,864	119.3	22.86	8	12,014	117.6	22.19
9	7,873	124.7	25.12	9	8,138	123.7	24.75
10	21,579	129.4	27.42	10	21,017	129.8	26.71
11	5,084	134.2	29.93	11	5,129	133.5	29.50
12	37,230	139.8	33.05	12	36,577	138.7	33.51
13	52,232	142.5	35.15	13	50,717	144.5	36.31
14	4,342	147.1	38.15	14	3,702	149.0	39.81

The gradual growth of hair on the pubes, commencing with a soft downy growth at about ten to thirteen, is a little more reliable, showing

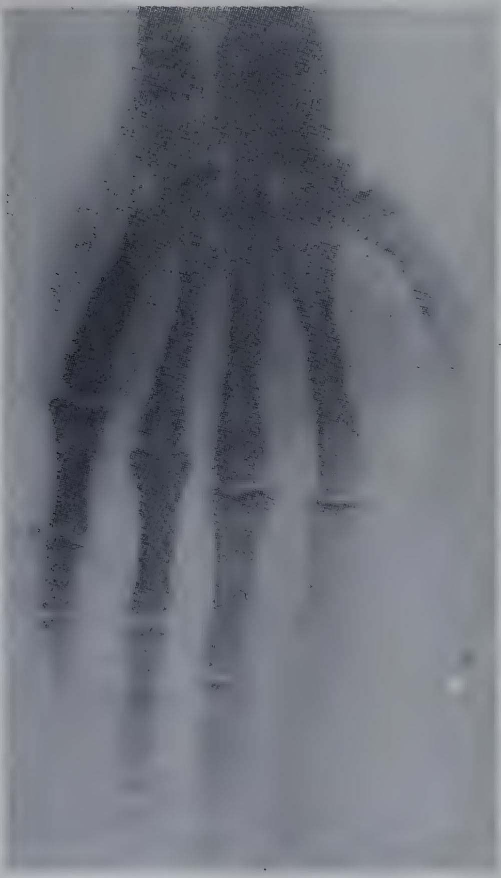

Fig. 16.

X-ray of the wrist and hand of a youth between fifteen and sixteen years of age. The epiphyses of the metacarpal and phalangeal bones are not yet united, and the epiphyses of the lower ends of the radius and ulna are widely separated.

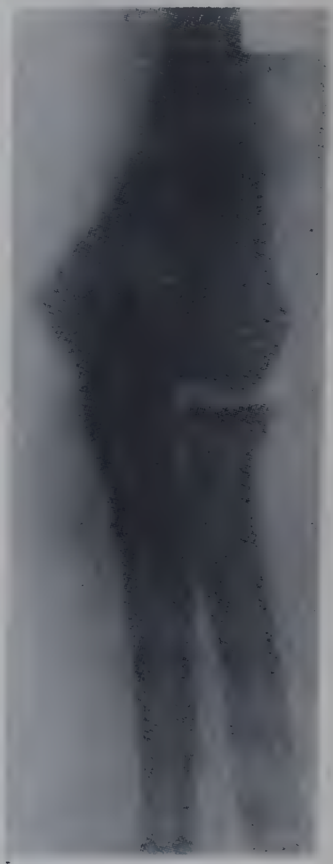

Fig. 17.

The elbow joint of the same case. The trochlea and capitellum have joined together and have almost united with the lower end of the shaft of the humerus. The internal epicondyle of the humerus is not yet united.

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[1] Tunford and Clegg, *Brit. Med. Jour.*, 1911, 1, p. 1423.

at least an approach to puberty. The development of the breasts in girls is variable, and liable to be altered by loose habits. In boys the voice undergoes a marked change as puberty comes on, losing its shrill infantile treble and taking on a deeper note, tenor or bass—"the breaking of the voice" in common speech. It must be stated that tastes, habits, and inclinations usually vary somewhat with age in children (comparing only members of the same sex), but some boys of fifteen are almost men in these respects, and others still children, and the same may be said of girls, some of whom are married at seventeen, while others at the same age are fitted only for the nursery.

Precocity. Cases of extraordinary precocity, although not frequent are by no means rare: many cases of menstruation in girls from six years of age are reported, with excessive development of the breasts and pubic hair; Dr. F. J. Smith once saw a boy of four with the penis and pubic hair of an adult. Such cases as we have said above are usually due to tumours or excessive development of the suprarenal cortex or of the pituitary gland.

Ken[1] records the case of a girl aged six years ten months who began to menstruate at the age of three-and-a-half years. She had well developed breasts and a prominent mons veneris on which there was fine dark hair. The uterus was almost of adult size.

AGE IN ADULTS

After the age of twenty-five there is little definite proof of age, whether in the living or the dead. It is true that common knowledge comes more or less to our aid, enabling us to make a fair approximation to the decade within which a person may be, but any closer approximation must be made with considerable reservation. The telltale crow's feet about the eyes may easily be produced by prolonged suffering, anxiety, or worry; white hair often comes on in quite young people from grief or shock, and often for no reason that can be estimated; tortuous arteries and arcus senilis (in the eye) are rarely seen before forty, but after that age they are of little value in estimating the age. Hence, in the absence of documentary proof or of some very exceptional circumstantial evidence, it is impossible to swear to the exact age of an adult.

The table of ossification inserted above may help materially up to the age of twenty-five to thirty; beyond that we may notice the ossification of the cartilages of the ribs, ossification of the thyroid cartilage, union of the greater horns of the hyoid bone to the body, union between the body of the sternum and the xiphoid and manubrium, obliteration of the sutures of the skull, thinning of the bones of the skull, etc., all of which occur in some degree after, say, forty-five to fifty years, or even a little earlier; an edentulous jaw suggests advanced age but is not proof of it. It is possible to estimate the age of a patient from his refraction. This can be done within five years or even less with an emmetrope.

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[1] *Brit. Med. Jour.*, 1937, ii, 620.

Medico-legal Questions concerning Age

The following preliminary remarks are of general application to all ages, and have a very special bearing on the duty of accoucheurs.

A child is not regarded by the law as born until it is **completely external to the mother,** but no mention is made of the severance of the cord, nor of the expulsion of the placenta, neither of which acts has in law any reference to the birth of the child, which is concluded directly the whole of the child has left the vulva. (For the effects of this statement on infanticide, *vide* " Infanticide.") Accoucheurs should always note the exact time when a child is being born about midnight ; if the presenting part be born before midnight and the remainder after that hour, the birth must be registered as having occurred on the day after the commencement of the parturition.

In law a child **arrives at a given year of age at the first instant of the day preceding his birthday,** in the common meaning of that word ; and in thus reckoning days no account whatever is taken by the law of parts of a day ; thus a child born at 11.59 on the night of May 3rd, 1923, is in law twenty-one the first moment after midnight of May 1st, 1944. It is obvious that in deciding cases of this sort nothing short of conclusive documentary proof or sworn evidence of reliable witnesses to the act of parturition will be accepted. For a case in point *vide* under " Age and Rape," page 138.

Evidence as to age may be demanded in the following circumstances :-

(*a*) As an aid to identification.
(*b*) In questions of criminal responsibility.
(*c*) In questions of rape and sexual offences.
(*d*) In connection with the competency of a witness.
(*e*) In the making of wills, etc.
(*f*) In contracting marriage.
(*g*) As regards capacity for procreation (involving impotence, legitimacy, etc.).
(*h*) In connection with civil employment and in protection of children.
(*i*) In connection with recruitment for military service.

(*a*) **Age in Identification.** If an adult man be missing, it is obviously useless to produce the body of a young boy as that of the missing man ; but there are so many other points in identity which have been fully discussed that precise evidence as to age is not of much intrinsic value by itself except in very rare circumstances, such, for instance, as in cases where a baby some few days old is alleged to be the new-born child of a lying-in woman.

(*b*) **In Questions of Criminal Responsibility.**[1] Infants are divided into three classes according to criminal law :

" (i.) *Those under eight*[2] *years of age.* There is conclusive presumption that children so young cannot have *mens rea* at all. Nothing, therefore, which they do can make them liable to be punished by a criminal court ; so a child of six, who was arrested for crime, obtained damages from the arrestor. But it is not illegal for parents to administer domestic punishment to such children, if they have in fact become old enough to understand it."

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[1] Kenny in " Outlines of Criminal Law," 1943, pp. 56 *et seq.*

[2] The age of immunity was raised from seven (as at Common Law) to eight by the Children and Young Persons Act, 1933.

"(ii.) *Between eight and fourteen.* Even at this age 'infants' are still presumed to be incapable of *mens rea*; but the presumption is no longer conclusive; it may be rebutted by evidence. Yet the mere commission of a criminal act is not, as it would be in the case of an adult, sufficient *prima facie* proof of a guilty mind. The presumption of innocence is so strong in the case of a child under fourteen that some clearer proof of the mental condition is necessary. This necessity for special proof of *mens rea* is impressed upon the jury who try such an infant, by their being asked not only the ordinary question, 'Did he do it?' but also the additional one, 'Had he a guilty knowledge that he was doing wrong?'"

"This guilty knowledge may be shown by the fact of the offender's having been previously convicted of some earlier crime: or even by the circumstances of the present offence itself, for they may afford distinct proof of a wicked mind. Thus a boy of eight was hanged in 1629 for burning two barns: 'it appearing that he had malice, revenge, craft and cunning.' Two boys, aged eight and nine respectively, were tried at Liverpool, in 1891, for murder; they had drowned another boy, in order to steal his clothes; but they were acquitted on the ground of their infancy."

Between the ages of eight and fourteen no presumption of law arises at all; and that which is termed a malicious intent—a guilty knowledge that the child was doing wrong—must be proved by the evidence. and cannot be presumed by the mere commission of the act.

In *R.* v. *Gorrie*[1] a boy of thirteen, while playing with other boys, slightly wounded one of them with a penknife, and caused his death through septic pyæmia. The jury acquitted the boy on the ground that when he "jabbed" the victim with the knife during the horse-play he did not know that he was doing that which was gravely wrong.

If, however, there is evidence to show that there was a guilty knowledge, a child even under ten years may be found guilty, on the principle of *malitia supplet ætatem*; but the younger the child, the stronger must be the evidence required for conviction. In these cases age is proved, not by a medical examination, but by the production of legal documents, or by the oral testimony of relatives.

A child under fourteen, indicted for murder or arson, must be proved to understand the nature and criminality of the act.

In *R.* v. *Vamplew*[2] a girl under fourteen years of age was convicted of killing a child by strychnine. It was shown that she was competent to understand the nature of the act.

"(iii.) *Between fourteen and twenty-one.*[3] A boy knows right from wrong long before he knows how to make a prudent speculation or a wise will. Hence at fourteen an infant comes under full criminal responsibility."

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[1] (1918) 83 J.P. 136.

[2] (Unreported.)

[3] Kenny, *loc. cit.*

By sec. 52 of the Children and Young Persons Act, 1933, no child under fourteen can be imprisoned ; and no young person can be sent to penal servitude or imprisonment (unless unruly). By sec. 53 sentence of death is not to be pronounced or recorded against a person under the age of eighteen.

The following table gives the various definitions of " child " and " young person " as to age :—

For registration and notification	At least twenty-eight weeks of intra-uterine life (Births and Deaths Registration Act, 1926).
To commence school	At least five years (Education Act, 1944).
To continue at school	Till fifteen (Education Act, 1944).
If blind, deaf, defective, or epileptic	A child is a child till sixteen (Education Act, 1944).
Restrictions on employment	Under twelve, general prohibition. Between twelve and eighteen, on specified conditions, subject to bye-laws made by a local authority (Children and Young Persons Acts, 1933 and 1938). Medical practitioners may give certificates as to the probability of a child's being injured by his work.
Children and Young Persons Act, 1933	" Child " means a person under fourteen : " Young person " means a person who has attained the age of fourteen years and is under seventeen.

(*c*) **Age in Rape and Sexual Offences.** The law has made certain definitions relating to age which are very important :

" (*i.*) A boy **under fourteen is** presumed to be **incapable of rape** as a principal in the first degree, *i.e.*, as the actual perpetrator of the offence, and even of committing an assault with intent to rape. Whether this (in certain cases) is wise or not is a matter with which medical men have nothing to do : they have simply to decide whether the boy is fourteen or not. If the registration-of-birth certificate can be produced this is conclusive. In the absence of such a certificate, the teeth and pubic hair are the most reliable forms of evidence. The size and development of his sexual organs may have produced severe injury upon the girl, and may suggest his being over fourteen, but the defence will require proof, not mere probabilities.

" (*ii.*) To have **connection with a girl under thirteen is a felony,** and consent is no excuse where the girl is under sixteen.[1] Where the accused is a man of twenty-three years of age or under, the presence of reasonable cause to believe that the girl was over sixteen years of age shall be a valid defence on the first occasion upon which he is charged with such an offence (*R*. v. *Ford*).[1] In *R*. v. *Chapman*[2] it was decided that this defence is available until the twenty-fourth birthday of the accused.

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[1] Criminal Law Amendment Act, 1922 ; see also Age of Marriage Act, 1929.

(*d*) **Competency as a Witness.** This is left almost entirely to the discretion of the judge; if he is satisfied that the child is old enough to appreciate the seriousness of the situation he may determine to accept the evidence. It is very easy to imagine circumstances in which children are the only available witnesses, and the judge may have to choose between accepting such evidence and allowing a criminal to escape. Where the child appears not to understand the nature of an oath, the judge may, in his discretion, postpone the trial in order that, in the meantime, the child may be properly instructed.

The Children and Young Persons Act, 1933, contains special provisions relating to the manner in which the evidence of a child of tender years may be received by the court. In this connection, see *R*. v. *Moscovitch*[3] and *R*. v. *Marshall*.[4] For a case where medical corroboration of a child's evidence was very important, *vide* under "Wounds."

(*e*) **In the Making of Wills, Borrowing Money, Pledging Credit, etc.** The law does not allow persons under twenty-one years of age the full power of disposing of property by will or even by gift; nevertheless, it permits persons to fix the age at which a legatee may assume full control of a legacy, but, as a broad general rule, no debt can be recovered by legal process from a person under twenty-one. The matter has, however, but little interest for the medical jurist, for in all such (and in many other) cases documentary evidence of age will be required, and not merely medical evidence.

(*f*) **In Contracting Marriage.** The statutory age in England is sixteen for both sexes.[5]

(*g*) **In Procreation, etc.** Before puberty, which is very variable in its onset, a boy is naturally sterile, though he need be by no means impotent. A girl before puberty is not necessarily either sterile or impotent, for cases are recorded of girls bearing children before menstruation (which is taken as the proof of puberty), and the vulva and vagina are certainly capable long before puberty of receiving the male organ. At the other end of life there is no known limit, while life exists, either to potency or fertility on the part of a man; and although women become sterile after the menopause, they are never impotent merely on account of age. The matter will be referred to again in discussing impotence and sterility.

(*h*) **Age in Civil Employment.** See above table under "Employment." The Children and Young Persons Acts 1933 and 1938 relate to the employment of persons under the age of eighteen years. The Acts contain provisions intended to discourage juvenile smoking; and they prohibit, among other things, the giving of intoxicating liquor to children under five.

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[1] (1923), 17 Cr. App. Cas. 99.

[2] (1931), 23 Cr. App. Cas. 63.

[3] (1924), 18 Cr. App. Cas. 37.

[4] (1925), 18 Cr. App. Cas. 164.

[5] Age of Marriage Act, 1929.

Identity of Mutilated Remains

A dead body partially putrefied may be found mutilated, and parts of it may be discovered in localities distant from each other. There is less difficulty here in making out identity than when bones only are discovered, for it is not always easy to say whether certain bones belong to the same skeleton or not. So long as the soft parts are attached to them, there will usually be no difficulty in forming an opinion. Those who commit murder, and thus dispose of a body, believe that identity must be entirely destroyed if they deposit the different parts in remote places. In this respect they are generally deceived, for satisfactory evidence may still be forthcoming.

Naturally, the first point in identification must be to determine that the fragments are of *human* origin. If merely pieces of muscle or viscera are found it may be difficult to decide by ordinary means but the precipitin test described on p. 411 should be tried, for that test is one for the proteins of the human body, which exist in muscle and other tissues as well as in blood.

If some skin is attached, or if bones are present, there will be no difficulty in saying that such bits are or are not human, and with considerable parts of, or whole, limbs judgment is still easier.

Having determined that the fragments are human, they must be carefully inspected to ascertain whether they all belong to one body or whether there are any incongruous or duplicate parts. In this regard the examiner must not be deceived by the fact that certain of the parts are more decomposed than others, for it is usual to find that the limbs are less easily putrified than the torso of the same body. The sex, age, stature and general development of the body should be investigated and a careful search made for marks of identification, as described in our foregoing list (scars, tattoos, fractures, hair, etc.). The means employed to separate the fragments (saw, knife, etc.), should be elucidated, and whether they have been carefully disarticulated or roughly hacked apart. The line of incision should be the subject of special study for it may prove definitely that certain parts belong to the same body.

It should be noted whether anatomical dissection has been carried out. On this Taylor remarks:—"When parts of dead bodies are found, a section of the public adopt the hypothesis that some medical student has resorted to this method of disposing of parts of a dissected subject. Thus, in the case of Greenacre, there was a disposition to refer the first portion of the mutilated remains which were discovered to a wanton act of this kind. The erroneousness of this view was proved only by the subsequent discovery of the corresponding parts of the body and the detection of the murderer. So in reference to the case of Parkman, the mutilated remains were at first described as anatomical preparations. Such an hypothesis is, of course, favourable to the escape of criminals, and is prejudicial to the course of justice. It points out to the assassin an easy method of deceiving the public; and it shows that if he only mutilates a corpse by removing and destroying the head, hands, and feet, leaving the remainder of the body to be discovered accidentally, he has a far better chance of escaping detection and punishment than by attempting to conceal the entire murdered body. The Waterloo Bridge case formed no exception to the protection thus unintentionally extended by public opinion to a foul act of murder. Anyone acquainted with anatomy and the dissection of bodies would at once perceive from the description that no portion of this body could have been used for such a purpose. Medical students do not, as part of their anatomical pursuits, hack and mangle a dead body so as to destroy muscles, vessels, nerves, and spinal marrow; they have no reason to make away with those parts by which a body may be identified, or to boil and salt the remainder; they do not receive corpses with their clothes for dissection, nor is there any conceivable reason why, if they did, they should produce cuts and stabs and stains of blood on the inside of the clothes with such accuracy as to correspond to the effects of wounds inflicted on a living man."

The parts should be fitted together as accurately as possible. When isolated bits are found at different times they should be carefully preserved in formalin; this, it is true, shrinks them somewhat, but it hardly prevents such fitting together as above suggested.

It should be ascertained to what treatment the parts have been subjected, for example, whether they have been boiled, burnt, or treated with chemicals.

If vital organs or large vessels are available, it should be noted whether injuries have been inflicted which might have caused death, and whether any injuries found were inflicted before or after death.

If the head is available the teeth may afford most valuable assistance in identity.

All scraps of clothing, wrappings, packing, etc., should be preserved as they may belong to the person who carried out the dismemberant; newspapers may be helpful in connection with the date of the crime. Any personal articles such as jewellery, watches, and so on, may provide important clues of identity.

The following cases are very instructive on all these points:

In the case of the woman Brown, murdered by Greenacre in 1837, the head, trunk, and limbs were scattered in widely distant parts of London. The limbs were not found until six weeks after the trunk, and then at a considerable distance and under very different circumstances. In the examination of the trunk, it was observed that the fifth cervical vertebra had been sawn through, leaving only about the tenth of an inch of that bone. When the head was found it was observed that the fifth cervical vertebra had also been sawn through, leaving only the posterior spinous process. On comparing the head with the trunk they fitted exactly, even to the continuation of a superficial cut on the skin. On afterwards comparing the trunk with the legs it was ascertained that the cut surfaces exactly corresponded. The thigh-bones remaining attached to the trunk, had been sawn through about an inch below the trochanters, to about one-half of their thickness, and then broken off. When the limbs were discovered six weeks afterwards, the portions of thigh-bones found exactly corresponded in the marks produced by the saw and in the portions broken. Not only were the parts of the body thus proved to belong to one and the same woman, but the individual was further identified by the peculiarity of the absence of a uterus.

In a case of infanticide the arm of a child was found concealed in a dust-hole of the house, while at about the same period a body without an arm and the head of a child were found in a ditch at some distance from the house where the accused person was living. The identity was, however, distinctly made out by the fact that the arm and scapula attached to it fitted exactly to the trunk, and that the incisions through the muscles and vessels completely corresponded.

On the occasion of a murder perpetrated at Brighton the head and subsequently the body of a female were found in different and distant places. They were identified as belonging to the same individual: first, from the fact that there were four cervical vertebræ attached to the trunk and three to the head; and secondly, from the divided vessels and cartilaginous rings of the trachea exactly corresponding. The importance attached to this kind of anatomical evidence shows that when a portion of a dead body is found, the whole of the parts which form the boundary of the section should be attentively observed and accurately described.

The case of Dr. Parkman, for the murder of whom Professor Webster was tried and convicted at Boston, U.S., in March, 1850, presents a remarkable instance of the value of scientific evidence in establishing the identity of a mutilated body. It also proves that even all the refinements of science *may* fail in the attempt so to dispose of a dead body in a case of murder as to prevent its identification. On November 23rd, 1849, the deceased was traced to the laboratory of the prisoner, and from that date he was missing. A week after his disappearance there were found concealed in the vault of a privy belonging to the prisoner's laboratory a pelvis (the hip-bones), the right thigh (from the hip to the knee), the left leg (from the knee to the ankle); and with them certain towels bearing the initials of the prisoner, and being such as were used by him. Among some cinders and slag connected with a furnace were found portions of bones, apparently of the cranium, fragments of vertebræ, blocks of artificial teeth, and some gold which had been melted. On the day following, in a remote corner of the laboratory, there was found a tea-chest, containing, embedded in a quantity of tan and covered with minerals, the entire trunk of a human body with the left thigh from the hip to the knee. When the parts were placed in apposition with the portions previously found, they corresponded, so that they were obviously parts of the same body. This observation also applied to the remains of bones (cranium and vertebræ) found in the slag of the furnace. There was no duplicate portion. All the fragments fitted so as to form part of the same human skeleton. The portions thus found resembled in every particular the body of Parkman, and in no single particular were they dissimilar from the body of the deceased. There were missing from these remains, when they were placed in apposition, the head, the arms with the hands, both feet and the right leg from the knee to the ankle.

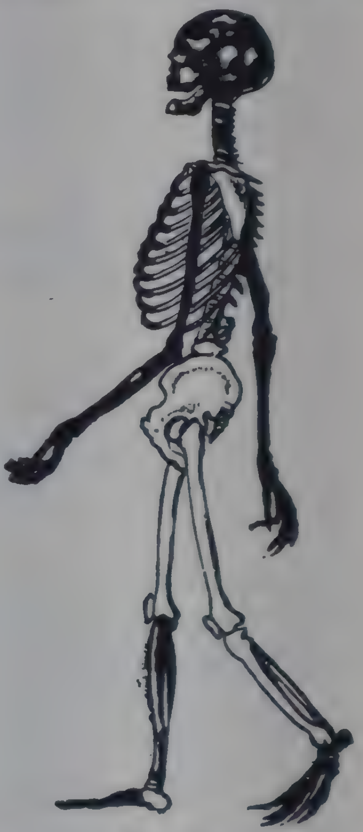

Fig. 18.

Dr. Parkman's skeleton restored
The missing parts are black.

The parts found, which are light in the engraving (Fig. 18), were examined by several medical men. They deposed that they were human remains, parts of one and the same male human body; that they had not undergone dissection for anatomical purposes, and had not been submitted to any process of preservation, further, that they had been cut and hacked in different directions without any reference to their anatomical relations, and evidently by a person only partially acquainted with the structure of the body. The chest was still covered with the muscles and skin. It was noticed that under the left nipple, between the sixth and seventh ribs, there was an opening which penetrated into the cavity. The opening was slightly ragged, and about 1½ inches in length.

It seems that Parkman was sixty years of age and his stature was 5 feet 11 inches. The portions of the body thus restored were those of a person between fifty and sixty years of age; and with respect to stature, the portions found, extending from the seventh cervical vertebra to the outer ankle (malleolus), measured 57½ inches. The distance from the sole of the foot to the outer malleolus, measured in another subject of the same age, was 3 inches; and the distance from the top of the head to the base of the sixth cervical vertebra was 10 inches. Adding these measurements to the missing portions the total length of the body found would be 5 feet 10½ inches, being within half an inch of the stature of Parkman. There were marks of identity about the teeth and jaw which left no doubt that the remains were those of the missing man. An attempt had been made to destroy the skin and flesh of the chest by the use of a strong solution of potash, but this had failed. The defence of the prisoner rested upon the fact that the charge was based entirely on circumstantial evidence, that the identity of the remains had not been satisfactorily made out, and that no cause of death had been proved. The jury, however, returned a verdict of guilty, and the prisoner was subsequently executed.[1]

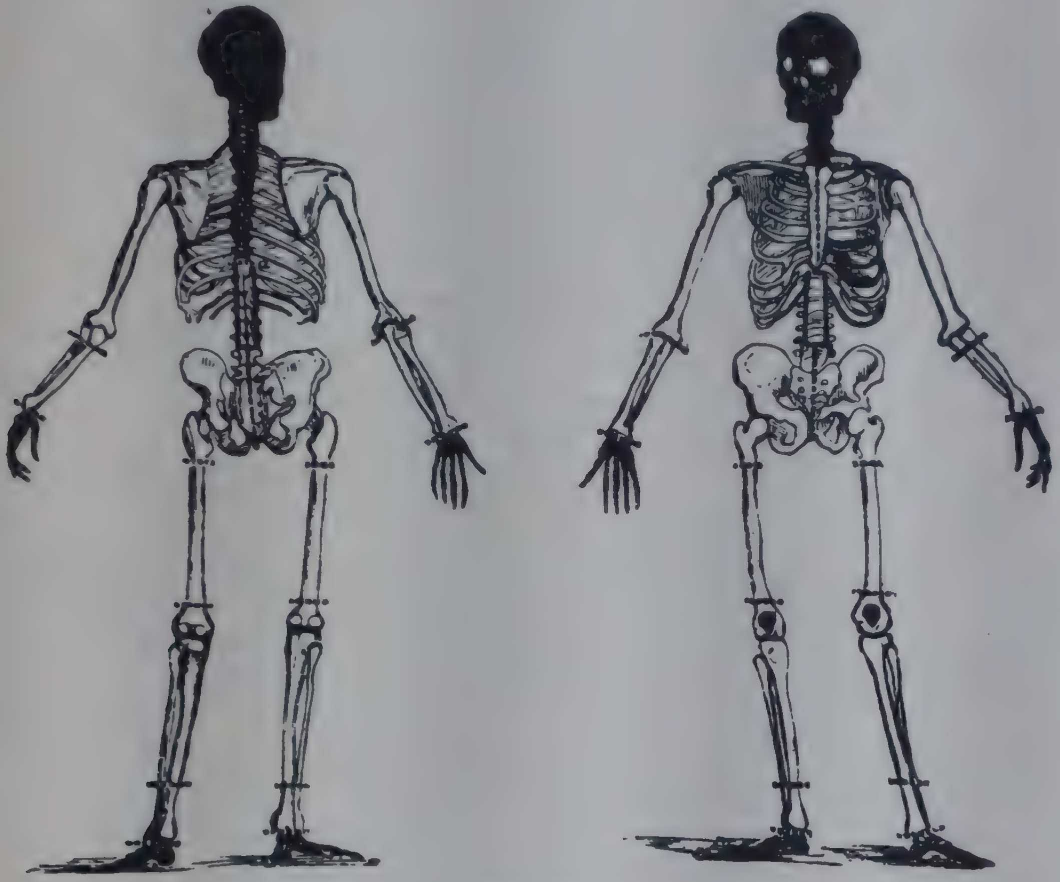

Fig. 19.

Waterloo Bridge remains restored. Front and back view of the skeleton. Dotted lines showing where the bones were cut or sawn. The missing parts are in black.

A singular case involving somewhat similar questions occurred in London in October, 1857, when the remains of a human being were found in a bag on one of the buttresses of WATERLOO BRIDGE. It appeared that they had been accidentally deposited there the night previously—the intention of the person who carried them being, no doubt, to lower them into the river, but by accident they lodged on one of the buttresses of the bridge. A number of articles of clothing were in the bag with the remains. These remains were submitted to the examination of the divisional surgeon of police and Taylor.

They found them to consist of parts of a human body, and obviously of the same body, as, when allowance was made for the missing portions, they admitted of an accurate adjustment to each other. There were twenty-three portions of the body discovered, consisting chiefly of bones with flesh adhering to them. The flesh had been roughly cut from the bones, apparently in order to remove as much of it as possible, and to destroy the identity of the body. The parts had been cut and sawn into small pieces, probably to reduce their bulk and to allow them to be packed within a small space. The trunk, including part of the chest and spine, had been cut into eight pieces; the upper limbs had been cut or sawn into six, and the lower limbs into nine pieces. The thigh and elbow-joints were in a strongly flexed condition. The missing portions, which are marked black in the engraving (Fig. 19), were the head, with the greater part of the spine, namely, fourteen out of twenty-four vertebræ (seven cervical and seven upper dorsal), the hands, the feet, and some portions of the left side of the chest. A murderer intending to destroy personal identity would, in general, most effectually succeed in his object by removing the head, feet and hands. The whole of the viscera of the chest and abdomen had also been removed. The twenty-three fragments found weighed only 18 lbs. This is about one-eighth part of the average weight of the adult body. The questions which required solution in this case were the following: (1) the sex, age and stature of the deceased; (2) the presence of any physiological or pathological peculiarities in reference to personal identity; (3) the presence of any wounds or marks of violence, with reference to the probable cause of death; (4) the general condition of the remains, in order to determine whether they were parts of a dissected body, and whether they had undergone any chemical process for the purpose of preservation; (5) the length of the period which had probably elapsed since the death of the deceased. The details of this examination will be found elsewhere.[1] There was no difficulty in determining the sex of the deceased, as a portion of the sexual organs, which had been mutilated (not dissected), still remained attached to the pelvis. The long bones were in their full state of development. The stature was determined by taking the length of the portions found, and adding a certain number of inches for the missing skull, cervical vertebræ, and feet. The bones had been sawn through near the joints with a fine bone-saw, such as is used by bone-boilers. On the left side of the chest, between the third and fourth ribs, there was a stab which had penetrated the cavity, and which, if inflicted upon a living person, would have been in a direction to enter the heart. The edges of this wound were everted and wide apart, and the muscles around were infiltrated with blood. It had those characteristics which are observed in wounds inflicted on a living body. No portion of these remains had the appearance of having undergone dissection or any preparation or use for anatomical purposes. There was no injection of blood-vessels; the muscles, vessels, and nerves had been cut through, or rather hacked in all directions, without any reference to relative position. The spinal marrow had been violently torn out of the vertebral canal, and was left hanging by its sheath to the vertebræ. The joints had been sawn through, evidently with great trouble, at points, where a scalpel, even in the hands of a young anatomist, would have speedily effected the separation of the limbs. Further, no preservative of animal matter had been employed. There was no trace of arsenic, corrosive sublimate, nitre, alum or chloride of zinc, in the soft parts. Portions of the muscular fibre were brown and sodden; they presented the appearance of having been boiled in water and soaked in a solution of common salt, which was separated from them by crystallisation. Portions of the skin, as well as the ligaments of the joints, had a similar appearance, *i.e.*, of having been submitted to the action of boiling water. From the conditions of the soft parts and joints, it appeared probable that the body had been cut up and exposed to a boiling temperature, while the members were in a state of cadaveric rigidity. From the condition of these parts, as well as other circumstances, they formed a conclusion respecting the probable period at which this person had died. The conclusions from the whole of the investigation were as follows:

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[1] See "Rep. of the Trial of Prof. Webster," by Dr. Stone, Boston, U.S., 1850.

(1) That the remains were those of a person of the male sex, of adult age, and of at least 5 feet 9 inches in stature. (2) That the parts found presented no physiological or pathological peculiarities by which they could be identified as belonging to any particular individual. The only fact observable under this head was, that the portions of skin remaining were thickly covered with dark hairs, and that the deceased was probably a dark, hairy man. (3) That the remains presented no appearance of disease or of violent injury inflicted during life, with the exception of a stab in the space between the third and fourth ribs on the left side of the chest. This stab was in a situation to penetrate the heart and cause death. It had the features of a stab inflicted on a person, either living or only recently dead. (4) That these remains had not been dissected or used for the purposes of anatomy. All those parts of the human body which are useful to an anatomist had been roughly severed and destroyed by a person or persons quite ignorant of their anatomical relations. They had been probably cut and sawn before the rigidity of death had ceased, *i.e.*, within from eighteen to twenty-four hours after death; and in this state had been partially boiled and subsequently salted (placed in brine). The body of deceased had not been laid out or attended to like that of a person dying from natural causes, whose body might be lawfully used for anatomical purposes. (5) That the person of whose body these remains were a part might have been dead for three or four weeks prior to the date at which they were examined, namely, on October 21st, 1857.

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[1] *Med. Gaz.*, October 31st, 1857, p. 445.

The articles of clothing found with the remains in the bag were those of a man nd a foreigner. They were much torn, and some presented the appearance of tabs and cuts, while all were more or less stained with blood, some of the stains resenting coagula. A stab through the double collar of an overcoat must have een inflicted with some force, as it was found to extend through corresponding arts of the undercoat and waistcoat. All these articles of clothing had stains of blood n the inside, and chiefly on the left side of the body, in the parts corresponding to he stab on the left side of the chest. The cutting and tearing of the clothing may ave arisen from the removal of the clothes while the body was in a state of rigidity n a constrained attitude. The state of the clothes was consistent with their having been worn by the deceased when he was subjected to violence which led to his death.

From inquiries made by the police, there was reason to believe that the remains were those of a Swedish sailor from a vessel then in the river. It is believed that he met with his death by stabbing, and that, after a short concealment, his body, cut up and mangled in the manner described, was disposed of by throwing it into the river. The head and other missing parts had probably been thus got rid of; and it was only by the accident of the bag lodging on a buttress of the bridge, instead of falling into the river, that these remains were found. As the deceased was most probably a foreigner whose name was not known, and of whose personal appearance no description could be given, there was no clue to the perpetrators of this murder.

In 1875, the remains of a woman, HARRIET LANE, were conveyed into the Borough, she having been murdered by her paramour, HENRY WAINWRIGHT, in Whitechapel. On September 7th, 1874, the deceased woman went in a cab to premises in Whitechapel Road, and was never seen again alive. In September, 1875, a year later, the premises were likely to pass from Wainwright into the hands of others; and he resolved to remove the body of the woman, whom he had murdered and buried, to another hiding-place in Southwark. A few days before, the prisoner employed his brother to purchase for him a spade and a small chopper or axe. These articles were found on the premises after the removal of the body. The chopper had on it putrescent animal matter, and on the spade was clay mixed with lime. On the same day Wainwright purchased three yards of American cloth and a quantity of cord. On September 11th, 1875, a man, employed by Wainwright, was arrested in the Borough, having in his possession two packages wrapped in similar American cloth and secured with similar cord, containing human remains. Upon being opened one parcel was found to contain the trunk, and the other the remaining portions of a thin human female, about 5 feet high, and about twenty-five years old. The body, which was supposed to have been dead about a year, had been recently and most unscientifically dissected. It was in a stinking and decomposed state; some parts were more or less mummified, whilst other parts were in a condition tending to adipocere. The body was, roughly speaking, divided into ten parts, as follows: two arms; two hands; the legs and feet connected, and left leg including part of the patella; the thighs including portions of the pelvis (the right thigh included the patella, the left thigh included part of the patella); the trunk, except the front of the pelvis; the head and neck. Though the woman had been dead a year and buried in a grave on the premises, certain parts had been well preserved, owing to the use of chlorinated lime, employed with the mistaken view of destroying the body, whereas it had acted as a preservative.

The cause of death was obvious. There were two bullets in her brain, and a third was found in a hair-pad at the back of the head. There was a cut extending from the centre of the throat to the angle of the lower jaw, which had severed all the tissues, and which must have been inflicted with considerable force. There could not be a doubt that the woman had been deprived of life by pistol-shots. There was reason also to think that the first shot was just behind the right ear, and the bullet was found to have caused an extravasation of blood 3 inches in circumference. Another bullet was found in the brain, having probably been fired when life was ebbing; and the third had flattened against a mass of hairpins, which had no doubt prevented it going into the head. Probably the murderer came up from behind, and fired the first shot at the back of the head; and, finding this ineffectual he had brought the pistol round and fired a second shot and then, not certain that it would answer the purpose of destroying life, the third shot was fired. The cut in the throat must have been inflicted either immediately before or immediately after death. As the principal arteries of the neck were divided, it would have been sufficient of itself to cause death. Probably this wound was inflicted after the pistol-shots had been fired.

In this case the identification of the remains was based partly on medical facts, and partly on the discovery of certain articles of clothing in the grave from which the body had been removed. The features were not recognisable. The body had been cut into ten pieces and much mangled. It was decomposed; but, as a quantity of chlorinated lime had been used in the burial of it, putrefaction had been in some degree retarded. The relatives could only speak generally to the slender form and stature of the body, and the smallness of the hands and feet, as points in which it resembled that of Harriet Lane. The light auburn colour of the hair, the absence of a tooth in the upper jaw on the right side, and the presence or a scar or cicatrix from a burn received many years before, and still remaining on the right leg below the knee, were also circumstances which strengthened their opinion. Some buttons and other articles of clothing found in the grave were identified by her relatives as similar to those which were actually worn by the deceased on the evening of her death. The direct proofs were: 1. *The age.* The age of the deceased was twenty-four. Judging by the wisdom teeth, three of which had appeared, this corresponded with the age assigned to the body. 2. *Stature.* It was inferred, but by no means directly proved, that the deceased was 5 feet 0½ inch in height. The remains, when put together, represented a stature of 4 feet 11¼ inches. This makes about an inch difference, which was accounted for by one of the medical witnesses as a result of the shrinking of the intervertebral substance, hence the defective length of an inch was consistent with the remains being those of a person of the height of the deceased. 3. *The colour of the hair.* This is stated to have been slightly different; but the difference was consistent with the hair of the remains having been buried for a year in the earth, and exposed to the action of chlorinated lime. But there are indeed so many women in the world with hair of a similar shade of colour that no great reliance can be placed on a resemblance of this kind in a disputed case of identity. 4. *The scar.* There was a scar or cicatrix from a burn in the right leg, below the knee. On removing the matter on the body which concealed such superficial marks, it was found in a part indicated by the father of the deceased woman. The scar was distinctly puckered, and presented all the usual marks of a scar produced by a burn from a red-hot poker. 5. *The state of the uterus.* The missing woman had had two children by Wainwright, the last having been born about nine months previous to her disappearance. From their examination of the womb, the medical witnesses for the Crown, Bond and Larkin, came to the conclusion that the woman whose remains were discovered had borne a child. On the other hand, Meadows, who appeared as an obstetric witness for the defence, stated that, in his opinion, the woman had never borne a child, an opinion which he qualified by stating that he believed it to be impossible to decide this question in any case with absolute certainty. If this witness had been able to testify positively that the indications of childbirth were certain, and could never be mistaken for an unimpregnated state of the uterus, his evidence would have gone far to show that this could not have been the body of Harriet Lane. The womb was described by Bond as much decomposed; the cavity large, but the walls thin; the os transverse and broad, and the neck projecting very little into the vagina. Larkin said that the general appearance of the uterus was most inconsistent with virginity, which fact, also, was to a great extent borne out by the appearance of the skin of the lower part of the abdomen. This showed here and there amidst the decomposition one or two white lines in the hypogastric region, and other marks of a darker colour, near to and in the inguinal region, apparently the remains of the violet lines which, together with the above-mentioned *lineæ albicantes*, are peculiarly characteristic, when taken in conjunction with other evidence, of delivery having taken place at some more or less remote period; and what seemed to bear out this idea more strongly was the fact that the decomposition had progressed more rapidly in the little raised portions of integument between the cicatrix-like lines than at any other part of the whole trunk, or upper part of the thighs, where the surface of the skin was even.

In 1879, in the case of Mrs. Thomas, who was murdered at Richmond by Kate Webster, the identification of the body was made by Bond, in spite of its dissection, the boiling of portions of it in a copper, and the entire absence of the head, which was never discovered.

The case of *Rex.* v. *Dobkin* (C.C.C. December, 1942) has many features of interest. Mrs. Dobkin disappeared on April 11th, 1941, during an air raid on London. Four days later a fire broke out on premises adjoining those at which Dobkin was employed as firewatcher. There had been no evening action that night and no reason for a fire. Two hours elapsed before the fire brigade was called.

Fifteen months later a demolition gang found certain human remains under a stone in the floor of the cellar covered with earth and lime. These remains, which were partially burnt, consisted of a head, trunk and parts of the arms and legs. A small quantity of brown hair turning grey was found. In the viscera was a uterus somewhat enlarged and containing a fibroid tumour. These remains contained no duplicate parts and were evidently those of an adult woman aged about 40–50. The height, as estimated from the humerus, the only long bone available, by Pearson's formula, was about 59½ inches, and, as estimated by assembling the body, 60½ inches. A fracture of the right horn of the thyroid cartilage with some blood clot around gave an indication that the cause of death was probably strangulation.

Enquiries showed that the wife of Dobkin was forty-seven years of age, about 61 inches high, had dark brown hair turning grey, and had been diagnosed as suffering from a fibroid tumour of the uterus. A doctor at the hospital recognised a photograph of Mrs. Dobkin as the patient who had attended for that complaint and had refused operation.

The teeth proved to be the culminating point in identification, as described on page 98.

The X-ray photograph of the skull was superimposed on a full face photograph of Mrs. Dobkin, and fitted precisely, suggesting at least that this skull could be that of Mrs. Dobkin and was unlikely to be that of some other person, as Mr. Justice Wrottesley said to the Jury.

The Court held that identification was proved and Dobkin was convicted of murder on the evidence presented.

The Ruxton Case.[1] Two women, aged 35 and 20 years respectively, the wife and maid of Dr. Ruxton, disappeared from Lancaster between the 14th and 15th of September, 1935. Two weeks later a quantity of human remains (68 portions) was found in a ravine near Moffat, about 107 miles from Lancaster. When the parts were assembled they were found to form two human bodies, aged about 35 to 45 years and 18 to 22 years respectively. Both bodies had been mutilated to remove all evidence of identity and sex. One thorax and pelvis only were present, disarticulated between the 2nd and 3rd lumbar vertebræ. The cut had passed through the left articular processes leaving a portion of the 2nd with the 3rd and the 3rd with the 2nd. This fact, together with other anatomical features, proved them to be parts of one trunk. The older head had been disarticulated between the 5th and 6th cervical vertebræ and articulated perfectly with the reconstructed trunk. The incision across the cricoid fitted perfectly also. The presence of a vagina in the pelvis proved the sex of this body. In the unassigned soft parts there were portions of two female external genitalia and three female breasts, thus proving that there were at least two female bodies present.

There were two pairs of upper and lower limbs, disarticulated at the shoulder and elbow, and hip and knee respectively. One pair of arms and a pair of legs could be assigned with certainty to the older woman, making a complete skeleton except for the right foot. There remained a head, two upper and two lower limbs. These were all definitely female in character and all approximately the same age, and although in the absence of the trunk they could not with certainty be assigned to the same person, they were undoubtedly the remains of the younger woman.

The stature of the reconstructed corpse of the older woman was approximately 5 ft. 4½ in., while that of the other, as calculated by means of Pearson's formula, was approximately 4 ft. 11 in. These heights corresponded accurately with the heights of the two missing women. Casts of the left feet of the two women fitted perfectly shoes belonging to Mrs. Ruxton and her maid. Photographs of the skulls when superimposed on life-size photographs of the heads of the two women showed a remarkable degree of fitting in each case (see Figs. 20 and 21). Professor Brash was careful to point out that this did not imply positive identity but only indicated that the skulls could belong to the missing individuals.

Vaccination marks on one body, and evidence of a bunion on the other, corresponded with conditions in the missing women. The finger nails of the younger were scratched, as might be found in a domestic servant, and her finger prints were identical with prints found on many articles in the house of the accused.

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[1] *Rex* v. *Ruxton*, Manchester Assizes, March, 1936.

The tips of the fingers and toes of the older body had been removed. With the bodies there were newspapers of the 15th September, certain garments which were identified, and a portion of a sheet which was identical, including a fault in the selvedge, with a sheet found in Ruxton's house.

The disarticulations had been carried out without damage other than small cuts in the cartilages, and were obviously the work of a person with a knowledge of anatomy. There was evidence of asphyxia in the organs assigned to Mrs. Ruxton and there was also a fracture of the hyoid bone. In the body assigned to Mary Rogerson there was a fracture on the top of the skull, bruises on the arms and face, and a deep bruise in the tongue, which showed leucocyte infiltration, suggesting that it had been caused an hour or two before death.

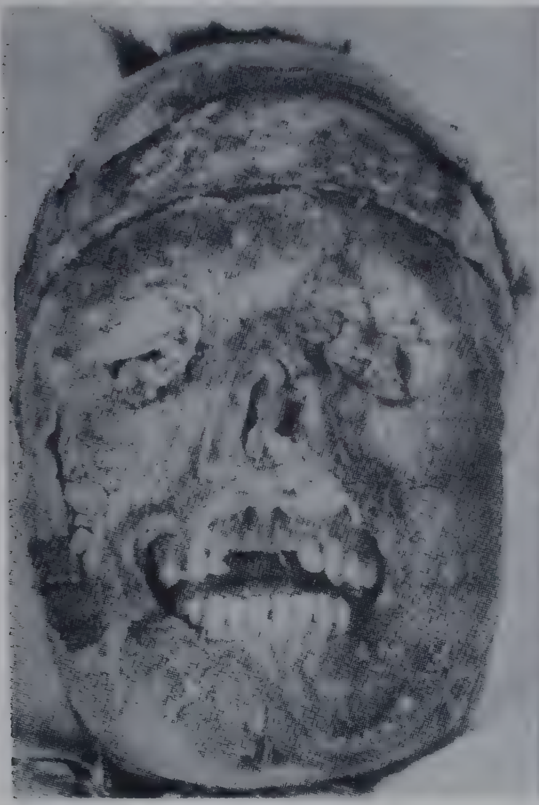

Fig. 20.
Head of the younger woman showing the extent of mutilation.

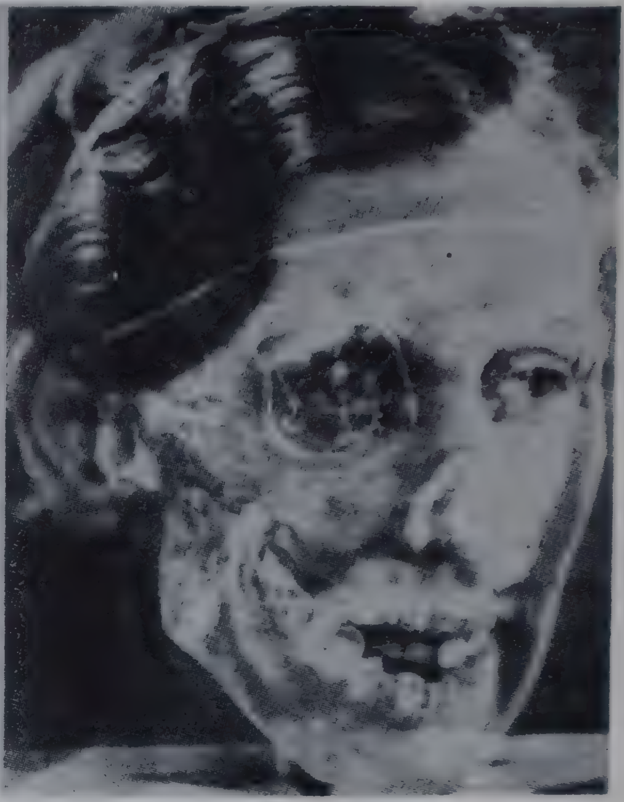

Fig. 21.
Skull of the older woman superimposed on a life-size photograph of Mrs. R. by Professor Brash.

In the house of the accused a number of human bloodstains were found in the bathroom and on the stair rails, stair carpets and pads; fragments of human tissue were found in the traps connected with the drains and a suit of clothes belonging to the accused was grossly contaminated with blood.

The accused was found guilty of murder and condemned to death.

Identity when Bones only are Left

When bones and possibly a few fragments of clothes are all that are left of a human being, the great majority of points of identification we have considered are not available, but a great deal of information may be obtained by careful and minute examination of anything found. Naturally, the first question that must be considered is :—

Are these Bones Human ? To answer this question, a thorough knowledge of human osteology is essential. The answers will be the more definite the more bones there are that are found ; but if a *complete* bone is found, or a reasonably large fragment, there should be no doubt on the matter. With small fragments the answer should be given with caution, unless something in the bone is decisive.

Taylor's original remarks on this subject were as follows :—

" The greatest ignorance prevails among the public on this subject. The bones of horses, cows dogs, and sheep are frequently mistaken for those of human beings. In an antiquarian collection of relics obtained from a neighbouring Roman castrum, Taylor recorded finding the tibia of a dog carefully labelled and religiously preserved as the bone of an ancient Roman. The same collection contained fragments of bones of various animals, carnivorous and herbivorous, all marked as human relics. This collection belonged to an antiquary, who had preferred adopting his own view of the nature of the relics to taking the opinion of anyone acquainted with anatomy. In a church in the north of England, two bones from oxen were shown as the thigh-bones of St. Lawrence. They were of ancient date and greatly prized by the sexton. Even well-informed men may be easily mistaken on such subjects. Belzoni, the celebrated traveller, brought from Egypt, with his sarcophagi, a number of bones taken from the interior of the Pyramids, which he pronounced to be the bones of King Cephrenes, and of some of the Shepherd Kings. Clift examined them after they had been submitted to public exhibition, and he found that they were the bones of oxen. The osseous relics of saints, as they are collected and preserved in glass and crystal cases in Roman Catholic countries, often present anomalies which would surprise an anatomist. Supernumerary ribs and vertebræ are not uncommon, and intermixed with them bones which certainly never appertained to a human being. In the medico-legal returns for India, 1868–9, it is stated that on one occasion, as evidence of an important murder, some bones brought from a distance of thirty miles, with the usual formalities and precautions as to identity, proved on examination to be those of a bullock, and on another occasion the remains turned out to be those of a goat. These facts show the importance of entrusting the examination of bones, in all judicial inquiries, to well-educated medical men. The lower classes of society are ever ready to suspect murder when bones are exhumed; and it will not always be easy to satisfy them that the bones exhumed could not have belonged to a human being.

It will be, in most cases, easier to say whether a particular bone has formed part of a human skeleton or not than to determine to what animal it may have belonged; this is commonly all that is expected from a medical witness. A moderate acquaintance with osteology will enable him to give an affirmative or negative opinion; but where part only of the shaft of a bone—as of the humerus, radius, tibia, or fibula is produced, some caution is required in forming a judgment.

At what date after burial or after death the precipitin test ceases to be applicable is not known, but it must be so long an interval that *all* soluble proteins have disappeared entirely.

Assuming that the bones are human, the questions that arise are:

(1) Are they those of a child or adult ?—age.
(2) Are they those of a male or female ?—sex.
(3) Do they represent one or more bodies ?
(4) What was the probable stature of the person ?
(5) What was his race ?
(6) How long have the bones been there ?
(7) Can the person be identified by the surroundings ?
(8) Is there evidence of the cause of death ?
(9) Identification from fractures and other peculiarities.
(10) Identification of burnt bodies.

(1) Age in Skeletons

We have already noted this fully under the heading of "Age in Identity," and have shown that the condition of the *teeth* and of the *bones* offers the most trustworthy indications of age in the dead. The size of the bones, as well as the degree of roughness of the ridges for muscular attachments, will also give some clue to the approximate age and development of the deceased person.

In a case of alleged infanticide there were found among the exhumed bones of two children parts of the jaws, containing the rudiments of the molar teeth, which appear about the eighth or ninth month of pregnancy. The fact showed, what was rather important to the inquiry, that the child to whom the jaw belonged must have been born at or about the full period.

It may be alleged that the bones are those of a child which has been murdered; but the medical witnesses may be able to prove, by an examination of the jaws, that the bones must have belonged to a child older or younger than that which is missing. There are numerous cases in which a question of this kind may become important. The determination of age by an examination of the bones of young persons is by no means so satisfactory as by the observation of the *teeth*.

When ossification is once completed it is difficult to determine the age by an examination of the bones. That the person has reached *adult age* will be indicated by the union of all the epiphyses to the bones, by the great firmness and solidity of the bones, with their rough surfaces for the insertion of muscles, their well-marked processes, grooves, and foramina. In the jaws, we may expect to find the wisdom teeth, while the other teeth will probably be found much worn, although this last sign is not of any great importance. The cranial sutures begin to be obliterated, especially in the sagittal and coronal sutures before thirty years. The closure is seen best on the inner side of the skull. Obliteration is more marked the older the skull, though it seems to proceed in a series of jumps. The other sutures of the skull close later in life than those mentioned, and closure of all sutures indicates a very old skull. Closure of the sutures of the skull sets in later in the female than in the male.

The bones of an old person are generally lighter than those of a young adult of the same size, the medullary cavities of the long bones being larger. The bones lose that ivory-looking character which they have in youth; and become yellow, more earthy, and brittle. Those parts of the skeleton which are cartilaginous in adults such as the thyroid and cricoid cartilages are commonly more or less ossified in old age. Calcification is seen in the rib cartilages and lipping may be noticed around the articular ends of the long bones and vertebræ. The bones of the cranium are thinner, the pacchionian pits more obvious and the vascular channels deeper. The teeth have either dropped out, or the crowns are worn away. Sometimes no trace of alveolar cavities is to be seen, the lower jaw being a mere rounded bone, with a smooth surface on each side. There is necessity for using extreme caution in giving an opinion respecting the age of bones, and in allowing sufficient latitude in years for the bones of adults.

Determination of Age from Stature. In attempting to determine the age of a skeleton from the measurement of the bones (see

"Stature"), it must be remembered that there is a great difference in the rapidity of growth, not merely in children of different sexes, but in children of the same sex. Sometimes a child will be much under the average stature before puberty, but will grow rapidly after having passed this period. The table on p. 134 may be referred to.

(2) SEX IN SKELETONS

The determination of sex from an examination of the skeleton or of certain detached bones can more readily be made in subjects which have passed the age of puberty, for sexual differences in the skeletons are not definite until adult age has been reached. The skeleton of the female is smaller and more slender than that of the male. The full-grown bone of a female is distinguished from that of a male by its ridges, depressions, and processes being less marked, the shaft of a long bone is smoother and more polished, while the articular surfaces and ends are smaller.

The size of the head of the humerus and femur are important indications of sex. According to Dwight[1] the boundary between male and female measurements of the head of the humerus lies between forty-five and forty-six millimetres for the vertical and between forty-one and forty-two millimeters for the transverse diameter.

Parsons considers that a measurement of over 43 millimeters in the vertical diameter of the humerus indicates a male bone and a measurement of under 44 millimetres a female bone. Pearson[2] considers that a vertical diameter of the head of the femur less than 41.5 millimetres indicates a female and over 45.5 millimetres a male, while a bicondylar width of less than 72 millimetres or more than 78 millimetres has a like significance.

The greatest difference is observed in the **pelvis,** and it is by an examination of this portion of the adult skeleton, when it can be obtained, that the sex may be most satisfactorily made out. These differences are noted in every text-book of anatomy, and only a few details need be added here.

The bones of the male pelvis are more massive and rougher, the curve of the iliac crest reaches a higher level, and its posterior extremity curves down more steeply to its termination. The pubic angle is narrower in the male; the body of the pubic bone is narrower and the pubic ramus much wider than in the female. The great sciatic notch is much narrower in the male than in the female. There are many other differences, details of which may be found in any text-book of anatomy.

Perfect has reported a case which shows the importance of attending to *sex* in exhumed skeletons. Two brothers lived together on a farm. The younger of the two was dissolute and irregular in his habits, so that they lived unhappily. One winter's night, when the ground was covered with snow, the younger brother absconded from the house by letting himself down from his chamber window; and when he was missing the ensuing morning, his footsteps were clearly traced in the snow to a considerable distance, but there were no footsteps of any other person. Nothing was ever afterwards heard of the missing brother. The elder brother left the farm, and it passed into the hands of a stranger. During the progress of some alterations in the grounds surrounding the house a skeleton was dug up. It was immediately conjectured that the one brother had murdered the other; an investigation was called for, and an inquest was held. Perfect, who was not summoned as a witness, requested permission to examine the bones. Having disposed them in their natural order, he found that they represented a person of short stature; and from the obliteration of the sutures of the skull, and the worn state of the crowns of the teeth, he inferred that they must have belonged to an aged person. On examining the bones of the pelvis it was perceptible that they had belonged to a *female*. When this fact was communicated to the jury, the two medical men, who had given their opinions from a hasty examination, were sent for, and one of them immediately corroborated the statement that the skeleton had belonged to a female. The proceedings were of course at an end, and a heavy suspicion amounting to a charge of fratricide, was thus removed from an innocent man. On further inquiry it was ascertained that the bones had been removed from an old gravel-pit, where gipsies had been accustomed to assemble and occasionally bury their dead.

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[1] *Amer. Jour. Anat.*, 4: 192, 1905.

[2] *Pearson K. and Bell.* A study of the long bones of the English skeleton.—Cambridge University Press, 1919.

(3) Do the Bones Represent one or more Bodies?

This point though obvious is nevertheless important. In old graves there will naturally be a greater chance of multiple burials than in the cases where a murderer has disposed of his victim. Still it is possible that two or more people (generally children) may have been murdered at the same time. The only way in which the point can be determined is by finding duplicate bones or too many bones to have belonged to one individual. Polydactylism must not be forgotten.

(4) Identity of a Skeleton from Disease, Fracture, or other Peculiarities

The existence or non-existence of *fractures*, and the progress which may have been made towards ossific union, may also become an important subject of inquiry. The body of Dr. Livingstone was identified by means of an old fracture of the humerus. In general the past existence of a fracture is easily determined in an exhumed bone by the appearance of a knot or ridge, or in some cases a thick deposit of bone where union has taken place; moreover, the marrow canal is likely to be obliterated at the point of fracture. In a fractured bone which has united in a curved form, it will be observed, on making a section, that the shell is considerably thicker on the side which has had to bear the greatest weight or pressure. All these facts, trivial as they may appear, may in reality be material in a case of disputed identity; and, unless carefully observed at the time, valuable evidence may be lost.

Questions of identity in relation to skeletons may occasionally be solved by reference to certain special characters of the bones. They may bear indications of disease, such as rickets, softening of the bones, or syphilis. There may be, again, some personal peculiarities, such as the presence of supernumerary fingers or toes, which, if observed, may tend to throw some light upon the case. An instance of this kind is mentioned by Orfila.

A man who had been residing in a small village in the neighbourhood of Montpellier, suddenly disappeared. It was some time afterwards reported that he had been murdered. It was only after the lapse of more than two years, that the magistrates were first induced to direct an investigation of the case. A thorough search was ordered, and the remains of a body, chiefly the bones, were found buried in a garden. It was, of course, essential to identify this skeleton as that of the deceased. It was well known that he had suffered from a singular personal deformity in having a sixth finger on the right hand and a sixth toe on the left foot. The bones, which were nearly all perfect, were carefully removed and put together, when it was found that those belonging to the two smaller toes of the left foot were wanting; but the metatarsal bone of the fifth toe had a process on the outer side, with a small articulating surface, which might have formed a supernumerary joint. The attention of the examiners was then directed to the right hand. The fifth bone of the metacarpus was shorter and broader than the one belonging to the opposite hand, while its digital extremity was divided into two parts, of which one formed a smooth, rounded articulating surface in the axis of the bone; while the other, which presented a more flattened articular surface, formed with it an angle of about eight degrees. On attempting to articulate the first phalanx of the little finger, it fitted exactly the first articular surface, and presented on the outer side a distinct groove, the oblique direction of which coincided with the direction of this second surface. This left no doubt of the nature of the peculiarity of structure, although the phalanges of the sixth finger could not be discovered. The left hand and the right foot were complete in all their parts. Other corroborating circumstances transpired with respect to the marks of violence on the body, and two prisoners were tried for murder, condemned, and executed.

Deformities of the spine, whether from old tubercle, mollities ossium, rickets, etc., or of the limbs, from fractures or bony anchylosis of joints, are easily observed, and may form well-marked points of identity. Every peculiarity should be noted, for any deviation from the normal may prove to be very important in identification.

A man suddenly disappeared. Three years afterwards an excavation was made in the cellar of the house where he and his brother had resided, and some human bones were discovered. Among other circumstances, the medical men to whom the examination of these bones was referred remarked that the body of the fifth lumbar vertebra was depressed and thin, as it is met with in rachitic individuals; that the pelvis was more contracted on the left than on the right side; that the tibia and fibula of each leg presented a remarkable curvature, greater, however, on the left than on the right side, so that the left leg was half an inch shorter than the right. There were certain peculiarities about the teeth of the lower jaw, the canines forming a considerable projection in front of the incisors. These facts, together with other circumstances, established the identity of the bones as being those of the person who had been missing.

(5) STATURE OF A PERSON DETERMINED BY THE SIZE OF THE SKELETON OR FROM SINGLE BONES

The average stature of Englishmen is from five feet six to five feet nine inches, or, according to Galton, five feet eight inches; about four out of one hundred are calculated to have a stature of from six feet to six feet three inches. In determining the stature from the measurement of the entire skeleton, it is usual to add from an inch to an inch and a half for the thickness of the soft parts. When the bones have become entirely disarticulated they should be laid out in their natural order and an estimate made.

Medical jurists have endeavoured to determine the stature of a skeleton from the measurement of one or more of the long bones, as, for example, of the femur, tibia, fibula, humerus, radius, and ulna;

but the older rules for this mode of calculation were unsatisfactory, and, as Devergie has shown from the tables, were liable to lead to an error of as much as five inches.

Rollet from a series of measurements on dead bodies and subsequent measurement of the bones after maceration calculated the following relationships between the stature and length of the bones :—

ROLLET'S TABLES

I.—Length of the Bones according to the Stature

Men

Stature.	Lower Limbs.			Upper Limbs.		
	Femur.	Tibia.	Fibula.	Humerus.	Radius.	Ulna.
Metres	mm.	mm.	mm.	mm.	mm.	mm.
1.52	415	334	329	298	223	233
1.54	421	338	333	302	226	237
1.56	426	343	338	307	228	240
1.58	431	348	343	311	231	244
1.60	437	352	348	315	234	248
1.62	442	357	352	319	236	252
1.64	448	361	357	324	239	255
1.66	453	366	362	328	242	259
1.68	458	369	366	331	244	261
1.70	462	373	369	335	246	264
1.72	467	376	373	338	249	266
1.74	472	380	377	342	251	269
1.76	477	383	380	345	253	271
1.78	481	386	384	348	255	273
1.80	486	390	388	352	258	276

II.—Length of the Bones according to the Stature

Women

Stature.	Lower Limbs.			Upper Limbs.		
	Femur.	Tibia.	Fibula.	Humerus.	Radius.	Ulna.
Metres	mm.	mm.	mm.	mm.	mm.	mm.
1.40	373	299	294	271	200	214
1.42	379	304	299	275	202	217
1.44	385	309	305	278	204	219
1.46	391	314	310	281	206	221
1.48	397	319	315	285	208	224
1.50	403	324	320	288	211	226
1.52	409	329	325	292	213	229
1.54	415	334	330	295	215	231
1.56	420	338	334	299	217	234
1.58	424	343	339	303	219	236
1.60	429	347	343	307	222	239
1.62	434	352	348	311	224	242
1.64	439	356	352	315	226	244
1.66	444	360	357	319	228	247
1.68	448	365	361	323	230	250
1.70	453	369	365	327	232	253
1.72	458	374	370	331	235	256

Karl Pearson[1], working on the figures given by Rollet, published the following formulæ for the reconstruction of the stature from the length of the long bones. These formulæ have been of the greatest assistance in numerous medico-legal cases, and with normal average people give a reconstruction value within one or two centimetres.

I.—Pearson's Formulæ for the Reconstruction of the Living Stature from Dead[2] Long Bones (in centimetres)

Males

(*a*) $S = 81.306 + 1.880\,F.$
(*b*) $S = 70.641 + 2.894\,H.$
(*c*) $S = 78.664 + 2.376\,T.$
(*d*) $S = 89.925 + 3.271\,R.$

Females

(*a*) $S = 72.844 + 1.945\,F.$
(*b*) $S = 71.475 + 2.754\,H.$
(*c*) $S = 74.774 + 2.352\,T.$
(*d*) $S = 81.224 + 3.343\,R.$

S = stature ; F = femur ; H = humerus ; T = tibia ; R = radius.

Remarks. (i.) The femur is measured from the head to the apex of the inner condyle. If the femur has been measured in the oblique position and not straight, add 0.23 cm. for male and 0.33 c.m. for female to the length before using the above formulæ.

tip (ii.) The tibia is measured from the upper articular surface to the of the malleolus. If the tibia has been measured with, and not without, the spine, subtract 0.96 cm. for male, and 0.87 cm. for female, from the length before using the above formulæ.

(iii.) The humerus and radius are measured in their greatest length.

II.—Formulæ for the Reconstruction of the Stature as Corpse, the Maximum Lengths of F, H, R, and T (without Spine) being measured with the Cartilage on and in a Humid State.

Males

(*a*) $S = 81.231 + 1.880\,F.$
(*b*) $S = 70.714 + 2.894\,H.$
(*c*) $S = 78.807 + 2.376\,T.$
(*d*) $S = 86.465 + 3.271\,R.$

Females

(*a*) $S = 73.163 + 1.945\,F.$
(*b*) $S = 72.046 + 2.754\,H.$
(*c*) $S = 75.369 + 2.352\,T.$
(*d*) $S = 82.189 + 3.343\,R.$

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[1] Philosophical Transactions of the Royal Society, Series A, vol. 192, pp. 169-244.

[2] The word "dead" is here used to denote a bone from which all the animal matter has disappeared, and which is in a dry state.

Should the stature of the living be required from the corpse statue then 1.26 cm. should be subtracted for the male, and 2 cm. for the female.

Below are drawn up the measurements of three adult male skeletons which were taken as accurately as possible by the repeated examination of the numerous skeletons in the museum of Guy's Hospital. Nos. 1 and 2 comprise nearly the average stature of Englishmen; No. 3 represents the skeleton of a tall man. The height here is the bare measurement of the bones with the soles of the feet resting on the ground. The lengths of the tibia and fibula were taken between the articular surfaces.

Adult Male Skeletons

	No. 1.		No. 2.		No. 3.	
	ft.	in.	ft.	in.	ft.	in.
Stature (sole on the ground) .	5	6	5	9	6	0
Transverse measurement from extremity of middle fingers	5	6½	5	10½	6	1
Femur . .		17⅜		18		19½
Tibia between		15⅜		14¾		15½
Fibula art. surf.		13½		14		14½

	No. 1. inches.	No. 2. inches.	No. 3. inches.
Humerus . .	12	12	13¼
Radius . .	9	9¼	9⅜
Ulna . . .	10	10⅜	10⅜
Clavicle . .	5½	6	6
Hand from carpus, joining the radius .	7	7¼	6½

The subjoined table contains the measurement of two female skeletons, the one of an adult, the other of an aged woman:

Female Skeletons

	Adult Female.		Aged Female.	
	ft.	in.	ft.	in.
Stature . . .	5	2½	5	0
Transverse length .	5	2½	5	0¾
Femur . . .		16		16
Tibia . . .		12¾		12½
Fibula . . .		12½		12¼
Humerus . . .		11⅛		11¼

	Adult Female. inches.	Aged Female. inches.
Radius . . .	8	7⅞
Ulna . . .	9	8¾
Clavicle . . .	5½	5
Hand from the wrist	6½	6¼

These are the measurements of the bones of the arm of a well-formed soldier:—

Arm of a Soldier

	inches.
Humerus	12½
Radius	9¼
Ulna	10¼
Clavicle	6
Hand from wrist . . .	7⅜

	inches.
Total length of arm .	29½
(29½ × 2 = 59, clavicles = 12, sternum = 1½, *vide* rules below.)	
Stature about 6 feet.	

Below are two measurements, the one of a male skeleton between *ten and eleven years of age*, the other of a mature child at the end of *nine months'* uterogestation. The dried cartilages at the ends of the long bones are not included in the measurement of the latter, because they are never found in graves ; we have merely the osseous portions to examine :

	Male Skeleton naturally articulated. ft. in.	Mature Child at 9 months. inches.		Male Skeleton naturally articulated. inches.	Mature. Child at 9 months. inches.
Stature	3 10	19¾	Ulna	6¾	2¼
Femur	11¾	3	Clavicle	4	1⅝
Tibia	9¾	2⅝	Hand from wrist	5	2
Fibula	9½	2½	Arms each		8¼
Humerus	8½	2¼	Measurement across the chest		3¼
Radius	6	2			

Foetal Bones. From measurements of the stature of fifty newly born children and the subsequent measurement of the dried bones *without* articular cartilages (*i.e.*, diaphyses only) the following ratios have been calculated :

Stature of child =

Femur	×	6.71	Radius	×	9.20
Tibia	×	7.63	Clavicle	×	11.30
Humerus	×	7.60	Lower jaw	×	10.00

The lower jaw is measured from the symphysis to the condylar surface.

The following tables are taken from Tidy's "Legal Medicine" :—

Average Measurement at different Ages, reduced to a Scale of 100

Age	Height.	Spine.	Circumference of Skull.	Humerus.	Radius.	Hand.	Femur.	Tibia.	Foot.	Pelvis.	
										Transverse Diameter of	Antero-posterior
Birth	100.00	36.84	79.00	18.50	13.20	16.30	22.00	18.50	18.50	6.80	6.80
2 years.	100.00	31.48	65.55	17.40	13.33	11.48	22.94	13.88	13.33	8.14	8.14
4 to 6 years	100.00	33.71	51.42	18.85	13.71	11.71	26.00	20.28	14.57	7.14	7.14
8 to 12 years	100.00	29.76	43.72	19.30	14.09	11.86	26.51	21.86	14.65	7.21	7.21
15 years	100.00	30.74	35.70	19.25	13.70	10.55	27.40	21.48	14.81	7.03	6.66
18 to 19 years	100.00	30.83	33.00	19.00	14.33	11.11	26.38	22.16	13.83	7.83	7.50
Adult	100.00	34.15	31.54	19.54	14.15	11.23	27.51	22.15	16.03	8.00	6.61

M. de S. Luca brought before the Academy of Sciences the results of his researches on the relative length and weight of the bones which constitute the human skeleton.

He demonstrated the existence of relative proportions among parts of the body which had not previously been suspected. His view is, that in the construction of animals there is among the various organs a uniform relation of weight, length, and surface. The average stature of an adult man is, according to him, five feet three inches (1 metre 60 centimetres), that of an adult woman one-twentieth less, *i.e.*, five feet. The head forms one-eighth part of the total height of the body ; this is divided into two equal parts immediately below the eyes, while the nostrils are midway between the eyes and chin. In a vertical section of the body, the pubis is a central point between the two extremes. When the arms are raised vertically above the head, the umbilicus or navel, which is one metre (39.37 inches) from the sole of the foot, then becomes the centre of the length. It may be further remarked that the height of a man corresponds to the distance which separates the extremities of the two hands when the arms are extended in a horizontal line from the body. The arm may be divided into five parts, the hand representing one part, while two others are occupied by the forearm, and the remaining two parts by the upper arm, the elbow being the boundary of these divisions. Whatever the length of the hand, five times that length will represent the total length of the arm, so that if the hand is 133 millimetres (5.24 inches) the arm will be 665 millimetres (26.2 inches) in length. In reference to the hand, the carpal and the metacarpal bones represent one-half of its length. The first phalanx of the middle finger is equal to one-fourth of the hand, and the two last phalanges of this finger, taken together, are exactly equal to the length of the first phalanx. The last phalanx is itself naturally divided by the nail into two equal parts. The sole of the foot is a third longer than the palm of the hands, but the back of the foot or instep is of the same length. The observations made on the weight of the bones showed : (1) That the bones of the right side of the body are heavier than those of the left. (2) The weight of the bones above the navel is equal to the weight of those which are below that point. (3) The weight of the bones of the hand is equal to the fifth part of the weight of the bones of the arm. There is the same relation here as in length. (4) The total weight of the hand may be divided into five parts, one represented by the carpal, two by the metacarpal bones, and two by the bones of the fingers. The first phalanx is equal to two-thirds of the weight of the entire finger, the other third being represented by the two remaining phalanges. (5) The bones of the hand are equal to half the weight of the bones of the foot. (6) In the foot there are similar relations. The weight of the tarsal is double that of the metatarsal bones, and the weight of the toes is divided into three parts, two for the first phalanges and one for the two small phalanages.

In the disinterment of the remains of William Rufus, an attempt was made to determine the stature of the king. The tibias were each sixteen and a quarter inches long, the thigh-bones were nineteen inches, and the spine was twenty-six inches in length. Comparing these measurements with those above given, the inference is, that Rufus was a tall man, nearly, if not quite, six feet in height.

(6) Determination of Race from Skeleton

There are certain differences in the skeleton according to the race to which it belongs. The differences chiefly relate to skull and face measurements, and the relative lengths of the upper and lower extremities, etc. The question is only likely to arise in seaports, though, of course, it might occur in other parts where foreigners were known to have lived. From the mixed nature of the population in England, and especially in London, Liverpool, etc., it is, perhaps, not unlikely that cases may arise in which a decision as to race may become very material.

It is inadvisable, however, for any medical practitioner to give an opinion about the racial origin of a skeleton, and the matter should be referred to a competent anthropologist.

(7) How long have the Bones been Interred ?

One of the first questions asked on the disinterment of bones relates to the length of time during which they have remained buried in the ground. The period at which the bones begin to undergo decomposition will depend upon that at which the soft parts have entirely disappeared. The common opinion is, that the soft parts are destroyed in ordinary graves in about ten years, but this depends on many factors, such as the kind of coffin, the nature of the soil, the temperature of the climate, etc. Bernt mentions a case seen by Navier in which some fleshy parts of the body remained after an interment of twenty-one years. In tropical climates complete destruction of the soft parts takes place with great rapidity. The changes in the bones are observed to commence by the loss of animal matter, so that they become lighter ; externally they acquire a dark incrustation when in contact with the earth. This dark incrustation is sometimes confined to the surface ; but in some very ancient bones the osseous shell is of a dark brown colour throughout. The animal matter is never entirely lost ; it exists in bones which have been buried for many centuries, and may be made evident by digesting them in hydrochloric acid. Even in sawing them the heat developed by friction brings out a peculiar animal odour. The shaft of a long bone becomes, after long burial in a dry soil, light and very brittle ; it may be easily broken, and cut or scraped with a knife. It appears to be impossible to assign, with any approach to precision, the period required for the production of these changes ; they vary with the age of the subject, taking place more rapidly in the skeletons of the young ; they vary also with the nature of the soil in which the bones are buried, according to whether this is dry or humid, sandy, cretaceous, or clayey. Some have alleged that the bones of a person buried in an ordinary coffin are entirely destroyed, with the exception of the skull and thigh-bones, within a period of thirty years ; but there are cases on record where the skull and long bones, and even the perfect skeleton, have been found in ordinary graves quite perfect after a much longer period. If the body has become mummified the bones, cartilages, and dried tissues may remain intact for thousands of years. In general the lower jaw of adults is preserved for a great length of time, and with it the teeth, which from the hardness of the enamel resist decomposition longer than any other part of the body. The ultimate destruction of the bone is effected by the complete disintegration of its earthy parts, the phosphate and carbonate of calcium falling into and mixing with the earth around. Bones owe their preservation to the large proportion of mineral matter contained in them. This is greater in the adult than in the child. Von Bibra found the following proportions of mineral matter per cent. in recent bones of different ages : in a woman (*æt.* 62), 69.82 ; in a man (*æt.* 25), 68.97 ; in a child (*æt.* 5), 67.80 ; in a child of two months, 65.32 ; in a fœtus of seven months, 65.19 ; and in a fœtus of six months, 59.62. The proportions in the bones of animals are similar to those of the human adult.

On the discovery of a bone, or a skeleton the question may be : Can it have been buried for a longer period than fifteen or twenty years ? Suspicion may arise that the bones were those of a person alleged to have been murdered, and who had disappeared about that period. In some cases this question may admit of a ready answer. If it is the long bone of an adult, and it is found to be light, friable, brittle, and easily scraped to powder, it is probable that it has been interred for a much longer period than that above mentioned. We can form only a rough opinion of the period of interment of bones by the presence or absence of the soft parts, of marrow in the interior ; by the firmness and weight or brittleness, dryness, and lightness of the bone. Even these criteria can scarcely be made applicable to bones preserved in durable coffins or vaults ; for in this state they are, to a great extent, removed from all the common causes of chemical change.

Devergie states that the bones of King Dagobert were found in a tolerably perfect state at St. Denis, although they had been buried in a vault twelve hundred years. In the year 1868 the skeleton of William Rufus was found in a stone coffin at Winchester, nearly perfect, after 780 years' burial. The skull was in fragments; the vertebræ were almost complete; parts of the pelvis and sacrum (showing the male characters), the bones of the arms, the femora and two tibiæ were found. The lower jaw, with nine teeth, the enamel apparently unchanged, was also discovered. There were no clavicles and only six ribs, and the small bones of the hands and feet had disappeared.

Taylor examined a portion of the scapula and rib of a skeleton which was found eighteen inches below the surface in the sandy soil on the top of a hill. The skeleton, which was that of a female, was perfect. excepting the lower ends of the tibiæ and feet, which were decomposed. It had the appearance of having been thrust violently into the ground. There were no traces of soft parts. The teeth in the upper jaw, including the wisdom teeth, were perfect and regular, and the age was considered to be from twenty-three to twenty-eight years. No hair or articles of clothing were discovered. On analysis the bones were found to contain 72 per cent. of mineral matter, and the presence of fluorine was detected in a small quantity of bone reduced to powder. The date of interment was assigned at from fifty to one hundred years.

Bones and teeth which have been long buried may, by percolation of water through the soil, become impregnated with ferric oxide, sulphate of calcium, or carbonate of calcium and magnesium. They are heavy, of a dark brown colour, and generally contain much lime and iron, with fluoride of calcium. In some bones, disinterred, near one of the plaster quarries of Paris, Lassaigne found, besides 66.7 of the usual mineral constituents, 2.3 per cent. of sulphate of calcium, with traces of ferric oxide. Other bones, of soldiers killed in 1814, and buried near the same spot, yielded 56.1 of phosphate and carbonate of calcium, 0.5 of sulphate, and 8.2 per cent. of argillaceous sand. These bones had been buried for a period of thirty-three years. They contained 15 per cent. of animal matter and 20 of water. Those taken from the plaster quarry contained the same quantity of water, but only 11 per cent of organic matter.

(8) Can the Body be Identified by its Surroundings Clothing, Hair or other Bones?

The discovery of certain articles of clothing known to have belonged to a missing person in association with the bones of a skeleton will sometimes remove any doubts that may arise on the subject of identity (see case of Miss Holland). Metal buttons, brooches, or rings, are imperishable, and should be sought for by sifting or washing the earth.

In *R.* v. *Platts*, the prisoner was charged with the murder of a man named Collis. The deceased had not been seen alive since December 7th, 1845. On August 28th, 1846, some men, in cleaning out a cesspool in the neighbourhood, found some human bones with certain articles of clothing, which were supposed to be those of the missing man. Besides the ribs, there were two thigh-bones and two leg-bones. The flesh readily came off the bones and fell into the soil. With these remains there was the ordinary dress of a man—namely, coat, hat, trousers, neckerchief, and two garters, one red and one white. These were still around the bones of the legs. Walker stated that he had examined the bones, and found them to be those of a male human being, from twenty-three to thirty years of age. All the bones were complete, excepting a few belonging to the neck, and three ribs. There was a deep fracture of the skull in the region of the forehead five inches in extent, another fracture over the left eyebrow, and a third across the base of the skull. These fractures, in his opinion, were inflicted on the body while living. The other bones, which appeared to have been separated by the yielding of the ligaments as a result of putrefaction, presented no marks of violence. The injuries to the skull were produced by some cutting or sharp-edged instruments, and were sufficient to cause death, which might have taken place either immediately or after some time. The clothes were identified as those worn by the deceased at the time of his disappearance, and the white and red garters found round the leg-bones were identified by a woman who made them, and gave them to the deceased.

The prisoner was connected with the act of murder by a chain of circumstances. On December 7th he was seen with a hammer in his hand, quarrelling with the deceased. At a later period he was seen with two men pushing the deceased, who appeared to be in a stupefied state, into his shop. On the night following he was seen in company with two men carrying an apparently heavy sack in the direction of the cesspool in which the skeleton was afterwards found. The prisoner had made false statements respecting the transactions between himself and deceased, and the watch and boots of the deceased were traced to his possession. The deceased had been seen with the watch up to within half an hour of his disappearance.

For the defence it was contended that there was not sufficient proof in law that the remains found were really those of the missing man. The finding of some portions of the clothes of the man in the cesspool was not sufficient to prove the *corpus delicti*—the murder. There must be positive evidence that the remains were those of Collis. Patteson, J., overruled the objection, observing that the identity of the remains were altogether a question for the jury. It was further contended for the defence that there must not only be clear proof that the remains were those of the deceased, but it must be proved that the deceased had died by the act of the prisoner, and not from any accidental cause. The prisoner was convicted.

But for the discovery of the clothes, more particularly of the two different-coloured garters round the leg-bones, the identity in this case could not have been satisfactorily established. The suggestion that the deceased might have fallen into the cesspool by some accident was negatived by the fact that, had this occurred, the watch and boots would have been found with the remains, whereas these articles were traced to the possession of the prisoner. It is worthy of note that in this case the dead human body, in clothes, was reduced nearly to the state of a skeleton within the short period of nine months. This must be ascribed to the influence of the putrescent animal matters by which it was surrounded. That the bones had not been for a longer period in the place where they were found was proved by the fact that the cesspool had been cleared out only a short time before the disappearance of the deceased.

In July, 1863, the bones of a child were found in a nursery-ground at Islington, under suspicious circumstances. It appeared that a girl named Elizabeth Hunter, aged eight years, had been missing from the neighbourhood since March 30th, 1862, and it was important to establish, if possible, that these were the bones of a female child of the age of the deceased. Until the skull was found it was supposed that the bones were those of a dog, but their human character appears to have been ultimately established by the discovery of the skull with some hair, and also of the lower jaw. The medical witness at the inquest assigned the age from eight to ten years, but could not well define the sex, as at this early period the sexual differences on the pelvis are not well marked. The articles of clothing found with the body served, however, to establish the sex, as well as the identity of the bones with those of the missing child. The remains had the appearance of having been longer in the earth than sixteen months, but it seems they were only superficially covered, and this might account for the rapid destruction of the bones and soft parts.

Other points of circumstantial evidence also demand attention—the position of the bones when discovered in the ground, whether lying at full length or grouped together confusedly. In bodies which have undergone Christian burial, the skeleton is found lying at full length, usually with the head to the west and the feet to the east, and one skeleton may be found below another. By an attention to these points the locality has been at once identified as the site of a burial-ground, where bones have been discovered during excavations or the foundation of new buildings. This inference is confirmed when the bones of persons of all ages and both sexes are found in or near the same spot. In 1866, a remarkable discovery was made at Milcote, near Stratford-on-Avon. Within two feet from the surface of the soil upwards of two hundred human skeletons were found. They were placed closely side by side upon their backs, with their feet to the east and their heads to the west, and all were well preserved. There were young and old, and skeletons of both sexes, the bones presenting no marks of injury from weapons. This was no doubt the site of an ancient but long-forgotten burial-ground. In prehistoric times the body was consigned to a stone chest in a sitting posture, with the arms clasped about the knees. Thus, in these ancient graves, the skeleton has been discovered with the thigh-bones folded on the chest. It is not unusual to find human mixed with animal bones. Occasionally, in ancient times, an animal was killed and buried with his deceased owner; and probably the disinterment of horse bones in old burial-grounds has given rise to the fables of giants. In one cemetery in the vicinity of London, the bones of the horse were frequently found when the excavations were carried on to a great depth. The bones of the ox have also been met with in graves mixed with human bones. Taylor had sent to him the upper part of the thigh-bone of an ox which was dug out of a deep grave in a country churchyard; it was forwarded to him as an unusually developed thigh-bone of a human being.

A man named Weekly Ball was charged with the murder of a woman named Lydia Atlee, with whom he had cohabited. It appears that, while in the last stage of pregnancy, she had suddenly disappeared on July 22nd, 1850, and was never seen again. It was rumoured that she had been murdered, and the prisoner, who, it was alleged, had a strong motive for getting rid of her, was suspected of the act; but no legal proof could be obtained against him, and the matter dropped. On February 3rd, 1864, as a labourer was digging in a lane, by the side of a ditch near the village of Ringstead, in Northamptonshire, where the deceased and the accused had lived, he found a human skull and ultimately a skeleton, lying at full length with its face downwards. The medical evidence at the magisterial inquiry was to the following effect: The skeleton was lying in a trench about twenty inches below the surface of the ground in a swampy soil. The feet were close together, the heels touching each other. From these facts Leete expressed an opinion that the body must have been buried naked. The skeleton, when laid out, was that of a middle-aged female, about five feet two inches in height. The bones were complete, excepting the right thigh-bone and skull, which were broken in their removal. He considered that the skeleton had been in the earth from twelve to twenty years. The missing woman was far advanced in pregnancy, but no *fœtal bones* were found. In reference to this the surgeon stated that the bones of a fœtus contained more animal matter, and might have been decomposed, although he declined to swear that within the period of fourteen years they would have entirely disappeared. No hair was found, although sought for, and no traces of clothes of any kind could be discovered. The ground was again searched for fœtal bones, and the result was that, about eighteen inches deeper in the earth, the skeleton of a full-grown man was found, foot to foot with that of the female skeleton above. That of the man was lying on its back, and the bones appeared to have been much longer in the ground. On this discovery it was suggested that the spot might have been a gipsies' burial-place, in which one body was laid in a grave over another without the ordinary clothing.

If any hair should be found with the bones it must be carefully preserved and examined.

(9) CAN THE MANNER OF DEATH BE ESTABLISHED ?

Indications of murder or violent death may be obtained long after the entire destruction of the soft parts.

Briand relates the case of a woman whose body was distinterred after eleven years' burial. It was believed and alleged that she had been murdered, and her body afterwards buried by her murderers. This was found completely reduced to a skeleton, but nevertheless the third, fourth, fifth, and sixth cervical vertebræ were still held together by a dark-coloured mass derived from the decomposition of the fleshy parts of the neck; and this mass was still surrounded by several folds of a cord, which had been employed as the means of strangulation. Proof was thereby obtained of the mode in which the murder had been perpetrated. It was also possible to determine the length and colour of the hair, the state of the teeth, and the form and length of the bones. A ring was found on the bones of one finger, which left no doubt whatever of the identity of the deceased.

In 1829, a man named Guerin was condemned at the assizes at Versailles for the murder of his brother. The murder had been perpetrated on August 21st, 1825, and the body had been buried in the corner of a damp cellar. The exhumation of the remains took place three years after interment, and it was ascertained by inspection that the deceased had been destroyed by blows on the cranium with a bruising instrument of large surface, and the identity of the deceased was clearly made out by the disposition of the teeth, the malformation of the vertebral column, and the curved form of the bones of the legs.

The case of Eugene Aram also furnishes an instance of the necessity for closely examining skeletons when it is suspected that the individuals have died from murderous violence. This man conspired with another to murder a person named Clarke. The deceased suddenly disappeared in February, 1745, and his absence could not be accounted for. In 1758—*i.e.*, thirteen years after his disappearance—some bones were accidentally discovered in a cave near the town where he lived. Aram's accomplice was arrested on suspicion; and, losing his presence of mind when charged with the murder, he denied that those were the bones, but mentioned the spot where the bones of Clarke were buried. A skeleton was there found, and the traces of a fracture and indentation of a temporal bone were plainly perceptible. The manner in which the murder was committed by the accomplice, and the medical evidence, corroborated this confession. Aram, who was a man of some ability, argued in his defence that it was impossible to identify a skeleton after a lapse of thirteen years; that the fracture of the skull and the piece of bone beaten inwards proved nothing; that it might have lain long in the cave where it was found, which had been a hermitage, and therefore a likely place of sepulture in ancient times; and that the violence to the skull might have been produced in times of disorder, when in searching for treasure the graves and coffins of the dead were violated. He also positively denied the conclusions as to the sex of the skeleton; but this objection was entirely set aside by the medical evidence. In spite of the ingenuity of this defence, the facts were too strong against him, and he was convicted and executed.

Aram's defence throws some light upon the questions of doubt which are apt to arise when evidence is given from the examination of exhumed bones. Thus, for example, we find three points strongly urged involving the consideration of the time required for the destruction of the skeleton, and therefore of its identity; of the form, situation, and appearance of a fracture of a bone, so as to enable a medical witness to determine whether it be of recent or of old standing, and whether it was likely to have been caused by accident previously to or during the exhumation, or had arisen from the direct application of violence to the skull during life. Lastly, a clear determination of the sex was required from an examination of the bones.

In *R.* v. *Dougal*, what was known as the "Moat Farm mystery" excited very great interest. The facts were as follows: Dougal, who was a married man, persuaded a Miss Holland to live with him at the Moat Farm. It was proved in evidence by a servant that Miss Holland left the house with the prisoner one day in August, 1899, and was never again seen alive. Various excuses were made by the prisoner to account for her non-appearance. Meanwhile the prisoner proceeded to deal with her property, and was arrested for forging the dead woman's name to a paltry cheque of a few pounds.

Inquiry led the police to believe that Miss Holland had been murdered by the prisoner, and her body disposed of by burial somewhere near the farmhouse. After prolonged search the remains of a human body were found buried in the bank of a ditch which the prisoner had caused to be filled in, upon the site of which he had had trees planted. Little was found but the bones, a few fragments of personal attire, a pair of boots and traces of internal organs, but there was enough to convict the prisoner, who was hanged. The main items of proof of identity and of the mode of death were the following: (1) portions of a skirt: this was identified by the deceased's dressmaker, who was able to swear to a peculiar mended portion of it, the witness having herself mended the skirt; (2) a comb or hair fastener of a pattern which Miss Holland's maid was able to identify; (3) remains of boots of a peculiarly small size, precisely corresponding to the size which deceased was known to have worn: they were of French make, and were distinctly identifiable; (4) the skeleton was that (*a*) of a woman, (*b*) of a person about the height of Miss Holland; (5) behind the position of the right ear was found a jagged fracture of the bone, with fragments carried inwards; the brain was sufficiently preserved for Professor Pepper, who performed the autopsy, to trace a wound through it from behind forwards and to the left, at the anterior end of which wound was found a bullet. With regard to proving that the bullet was one which might have been fired by the prisoner, there was some little difficulty so long after the event, but there could be no doubt whatever that the person whose remains were found had been killed by a bullet fired from behind, and the circumstantial evidence was sufficient to prove (*a*) that the body was that of Miss Holland, and (*b*) that the prisoner was the only person who could have fired the shot, and (*c*) that he had opportunity and motive (!) for doing so.

In reference to injuries found in skeletons, it is of great importance to attempt to determine whether the injury had occurred during life or by accident during the exhumation, and if during life, whether it were recent or of old standing. This is difficult in cases in which the injury took place shortly before death, but if any attempt at healing has taken place this will still remain and will prove definitely that the fracture was of some standing.

In this connection it must be remembered that in the skull small portions of bone not infrequently ossify from irregular independent centres and remain for some time as small bones separable by maceration and disarticulation and known as **ossa triquetra**. The aperture left by the separation of one of these bones may be mistaken for a fracture produced by a weapon, but the difference is usually well marked. If, on the one hand, the bone has not yet united with the others, the edges of the opening will be found quite thin and, as it were, bevelled off, and possibly membrane may be found on the edge. If, on the other hand, it has united, then the serrate suture or line of junction with the other bones can hardly be mistaken for the appearance of a fracture ; it will be too regular without any splintering. Careful search should be made for the hyoid bone, for this structure is often fractured in strangulation and seldom by anything else.

The dead body of a new-born child, wrapped in brown paper and a towel, was found in a pond. The head was much decomposed, and the scalp was extensively lacerated and destroyed over the parietal bones, which readily separated. The brain was reduced to a pulp. The umbilical cord, which had not been tied, was cut obliquely at about six inches from the navel. The lungs, which were very crepitant, readily floated on water, and bore up the heart. The body was generally bloodless. The point of difficulty which the case presented consisted in the presence of two apertures on one parietal bone. These apertures were small and rounded, and it was at first doubtful whether they had not been wilfully produced by some perforating instrument applied to the head. The aperture was situated near the temporal ridge, and in this situation the scalp was entire and uninjured. The other was situated in that part of the bone which corresponded to the lacerated portion of the scalp. No violence had been used in the removal of the body from the water. The bone was macerated, and carefully examined by the aid of a lens. The apertures were quite regular at the edges, which were remarkably thin, evidently passing into a membranous condition. The internal table was also deficient, so that, from the interior, the bone was bevelled off gradually from each aperture. This examination left no doubt that the holes in the bone were not due to any mechanical violence, applied during life, but to deficient ossification. These spaces had been membranous, and the membrane destroyed by decomposition. The putrefaction of the scalp, and its separation, might have been accelerated by a bruised condition of these parts during a difficult labour. These natural defects are generally well characterised. They may be found at all ages.

(10) IDENTIFICATION OF BURNT BODIES

The bones which we are required to examine may have undergone *calcination*. In several cases of murder which have occurred, an attempt has been made to dispose of the body by burning. This method of disposing of a dead body is by no means unusual in cases of alleged infanticide and concealment of birth. There is little difficulty in deciding whether a bone has or has not undergone calcination. Its character is entirely altered. Its shape may be preserved, but if burnt in the open air, it will be white ; if in a close fire, it will be black or ash-grey. The bone is brittle, easily pulverisable, and dissolves in hydrochloric acid, leaving, if perfectly calcined, only some charcoal, but no animal matter.

In *R.* v. *Varney*, the accused had been delivered of a child, whose body had been burnt, and only a few remains of the bones of a human fœtus were found in the ashes of a grate. The accused was convicted of concealment of birth.

In a case like this, in which an attempt had been made to destroy the body of a child by burning, it will, of course, be necessary to have good evidence that the bones are those of a *human fœtus*, or child. A small fragment only of either end of any well-marked bone will suffice for identification. If the jaws be forthcoming, the alveolar cavities should be sought for, and the number and condition of the teeth noticed. The period of uterine life which the child had attained may be thus in some instances determined, as also by the presence or absence of certain ossific points in the bones.

If the body has been burned to a complete ash or powder, it will then be difficult to identify the bones. Orfila was consulted in a case of this kind, where a woman had burned a child in an oven, and its ashes had become mixed with those of wood. He suggested that on calcining the residue with potash the ashes of a human fœtus might be known by their yielding cyanide of potassium, owing to the nitrogen which would remain in and about them. The ashes of wood do not yield the cyanide in similar circumstances. The conclusions drawn in such circumstances might, however, lead to a serious error : the presence of a flannel dress, of an old hat, shoe, or any nitrogenous substance, would on incineration give rise to precisely similar results. When the *form* of a bone cannot be recognised, all that medical evidence can accomplish may be thus stated : The detection of a large quantity of *phosphate of calcium* in the ash would suggest that bones were present, and thus distinguish the ash of bone from the ashes of other substances. Still the bones might have belonged to an animal, and not to a human fœtus. There are no accurate means of distinguishing the ash of human from that of animal bone, or the ash of fœtal from the ash of adult bones.

In the case of the Lemoines, mother and daughter, tried before the French courts in 1859, the evidence went to show that the elder prisoner (the mother) burned the body of a child of which her daughter had been secretly delivered. Some bones of a child were recovered, and amongst others the frontal bone. The medical evidence was to the effect that the bones were those of a child which had reached about the seventh or eighth month. Upon this corroboration the jury convicted the elder prisoner, and the court sentenced her to twenty years' imprisonment.

In a case of concealment of birth, it was proved by medical evidence that the prisoner had been recently delivered of a child of not less than seven months' uterine age. She said that she had burned the body to conceal her shame, and had buried the remains in a garden. Some bones which had been calcined were there found buried in ashes, and after an examination of them a medical man stated that they were the bones of a child nine months of age ; but in comparing them with the skulls of nine-months children in museum collections it was admitted that the skull of which the parts had been found and restored was larger. This admission threw some doubt on the identity of the bones, and the prisoner was discharged.

In 1863, a man named Barton, a fireman employed at a coal-pit near Wigan, was missing. From the appearance of blood about the mouth of the steam furnace and the discovery of a burned portion of the clothing worn by the deceased there was reason to believe that the man had been murdered and his body thrust into the furnace. Edwards examined the ashes of the furnace and found—(1) portions of the occipital bone of a skull ; (2) base of the skull and two fangs of teeth—a fang of an incisor and a fang of a molar tooth ; (3) portions of the arches of the dorsal vertebræ ; (4) a portion of the lumbar vertebræ ; (5) a portion of the head, body, and joint of the humerus ; and (6) a portion of the head and joint of the thigh-bone. These bones had been heated to a high temperature, which had destroyed their internal structure, but the external form was well preserved. They were all human bones. A chemical and microscopical examination of some of the clinkers showed that there was blood upon them, having the character of human blood. There was no doubt that these were the remains of the missing man. He was last seen alive at eight in the evening, and at four the following morning nothing remained of him but the few bones above mentioned.

Vide also the case of Dr. Parkman (p. 142).

Official Exhumation of Bodies

Identification of a body for medico-legal purposes receives one of its best illustrations in official exhumations.

An order for an exhumation is always obtained from the Home Secretary,[1] most commonly on the request of a coroner when suspicions of poisoning, murder, or alleged malpraxis have arisen subsequently to the burial of a person, but occasionally an order is granted for other purposes, as, for instance, that granted in 1907 for the exhumation of the body of Mr. Druce, owner of the Baker Street Bazaar, who was said by his elder son Herbert to have died in 1864, and by the widow of his younger son Alfred to be the same person as the Fifth Duke of Portland, and therefore living till 1879. This was granted for purposes of simple identification to set at rest rumours that the coffin was empty, and that the Duke might yet be alive. Orders are also, of course, granted in such cases as removing or pulling down an old church, or digging up an old burial ground, but with such a medical witness has very little concern.

We must then consider the general principles of exhumation so far as they concern the medical witness. The steps necessary to obtain an order are purely legal. The body of a deceased person when exhumed should be identified by some friend or relative, in the presence of the medical examiner. In one case of murder by poison the evidence almost failed owing to the omission to take this precaution. The order of the Secretary of State does not warrant the examination of any body except that of the person named in the order, and the finding of a human body in a coffin does not prove that it is the body named on the coffin plate. The body of a male has more than once been found in a coffin bearing the plate of a female, and *vice versa*. Again, coffins with name-plates have been exhumed and found to be empty! But it is necessary to insist upon still closer identification. The name of the deceased person whose body is sought may be a very common one, and bodies with similar names on the coffin-plates may be buried in the same plot or in the same grave. Hence it is of paramount importance that the exhumed body should not only be identified as that of A. B., but of the particular A. B. whose death is being inquired into.

The following is Lowndes' verbatim report on a case. It furnishes an illustration of how an exhumation should be done so that no doubt may exist as to the body which has been examined :—

Exhumation of Margaret Jennings, 295 days after death, 292 after burial. On Friday, the 16th November, 1883, I attended at Ford cemetery, which is for the the exclusive use of Roman Catholics. On my arrival I was met by Detective Inspector Boyes and the superintendent of the cemetery, who conducted me to the public portion of the cemetery. In a recently opened grave was a coffin which was supposed to be that of Margaret Jennings. The coffin-plate had just been removed; it was little changed, and bore the name "Margaret Jennings, died 25th January, 1883, aged 18."

The father of the deceased (Patrick Jennings) was present, also a woman named Agnes Wharton, and William Lukeman (foreman to Mr. Brumby, undertaker), who conducted the funeral of the deceased. The grave was made partly of sand, partly of clay, and the coffin, a pine deal one, remained intact. There was some effluvium, but the coffin appeared quite secure. Lukeman identified it as one of Mr. Brumby's make. In reply to my question, the deceased's father stated that he would be able to identify his daughter by her hair, which was dark brown; he also added that she had no false teeth, but good teeth of her own. The coffin was then raised and removed to the Prince's Dock Deadhouse, as the cemetery was not within the district of the coroner of Liverpool. Detective Musgrave accompanied the coffin, and Inspector Boyes went with me. On the arrival of the coffin at the deadhouse it was opened by Lukeman. A piece of muslin over the face adhered to it. The grave-clothes were entire, though much soiled. There was a good deal of effluvia at first. The body was that of a female of eighteen years or thereabouts, rather short in stature, with dark brown hair. Patrick Jennings and Agnes Wharton distinctly and positively identified the body as that of Margaret Jennings. It was then removed from the coffin, well washed with cold water from a hose, and carefully examined. The surface showed decomposition. The eyes were gone; the cartilages of the nose had disappeared; the hair was loosening from the scalp and easily pulled out. I removed some of it, and delivered it to Detective Boyes. The mouth was open; the teeth were loosening; the skin was peeling off, and came away with the clothes on removing the latter. The nails on the fingers and toes were adherent to the parts beneath and perfect. There was a quantity of dark-coloured hair about the pubes.

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[1] In Scotland application is made to the Sheriff.

On opening the chest I found a considerable amount of fat in its walls. The lungs and heart were much decomposed. On opening the abdomen I found a good deal of fat in the mesentery as well as in the walls of the cavity itself. The stomach and duodenum were empty and much softened. The liver, spleen, kidneys, all the intestines and pelvic viscera, were fairly well preserved. In the presence of Detective Boyes and Musgrave, I placed the stomach and all the intestines, portions of the liver, the spleen, left kidney, the urinary bladder, uterus, and appendages, into five glass jars, specially bought and cleaned for the purpose, as follows:—

No. 1, containing stomach and duodenum.
No. 2, portions of liver, the spleen, left kidney.
No. 3, large intestines, except rectum.
No. 4, small intestines (jejunum and ilium).
No. 5, urinary bladder, uterus, and rectum.

Each jar was secured with a close-fitting glass stopper, covered with skin leather, tied down with stout string, and two private seals were affixed to each. The seals were (1) my initials, "F.W.L.," and (2) a crest with motto. Each jar was labelled "Margaret Jennings," with separate numbers—1, 2, 3, 4, 5—affixed to each, with the date of Nov. 16th, 1883.

I opened the head, and found the brain to be in an almost liquid state from decomposition. The upper part of the spinal cord was easily seen through the foramen magnum; it was softening, though firmer than the brain.

I delivered the jars to Mr. Edward Davies, analytical chemist at the Royal Institution Laboratory, that same day, and subsequently I examined the various viscera at Mr. Davies' laboratory in his presence. The small intestines were empty, as was also the rectum. There was some faecal matter in the colon, and patches of redness throughout the small intestine and rectum.

We may call attention to the following points in the above report:

1. The soil in which burial had taken place was noticed (*vide* "Decomposition"), but no sample was taken for analysis.

2. The coffin was identified by its make and material as one commonly made by the particular undertaker who buried the body.

3. The name-plate was identified.

4. The body was identified by as many people as possible.

5. The stage of decomposition was noticed.

6. The viscera were preserved in separate, clean, secured, and labelled bottles (*vide* "Poisoning," Vol. II.).

It is important that the viscera taken from a body which has been long in the grave should be sealed up immediately. They should not be allowed to come into contact with any metal, nor with any surface except that of clean glass or porcelain. They must not be allowed to be contaminated with dust or earth from the grave. It has been recommended that they should be washed with chlorinated lime, or placed in lcohol ; but this is decidedly improper : the use of any preservative hemical liquid would not only embarrass the future analysis, but would render a special examination of an unused portion of the liquid ecessary, the identity of which would have to be unequivocally stablished. Preservation from air in clean glass vessels, with ight-fitting glass stoppers or corks, covered with sheet india-rubber or gutta-percha, is all that is required in practice.

A portion of earth immediately above and below the coffin should be removed for analysis, and also portions of the wood of the coffin and burial clothes.

So long as the coffin remains entire there may be some expectation of discovering poison by analysis, but decomposition may have proceeded so far as to destroy all gross pathological evidence either of poison or of wounds, marks of strangulation, etc., but it may be laid down as maxim that it is never too late to attempt an autopsy, for evidence may be found of quite an unexpected nature, possibly throwing considerable light on an otherwise obscure case. Thus scars, tattoos, hair, the teeth, and in fact any of the points of identification may still be visible on careful inspection, and may lead to a correct identification of a body that may have been buried under a wrong name, and upon which correct identification most important issues may depend, whether these be of a civil or criminal nature.

In the "Trans. of the Med.-leg. Soc.," vol. 6, 1908–9, will be found a very interesting article on the Law of Exhumation, with numerous authorities cited, but it has no special *medico-legal* bearings, and therefore requires no farther notice here.

CHAPTER V

DEATH

ITS SIGNS AND THE CHANGES THAT TAKE PLACE IN THE BODY AFTER DEATH

These will be discussed in the following order :—

1. Cessation of circulation.
2. Cessation of respiration.
3. Cooling of the body.
4. Insensibility and loss of power to move.
5. Changes in the skin.
6. Action of heat upon the skin.
7. Changes in and about the eye.
8. Changes connected with the blood.
    - (*a*) Coagulation.
    - (*b*) *Post-mortem* bleeding.
    - (*c*) *Post-mortem* hypostases.
9. Changes in the muscles.
    - (*a*) Period of irritability.
    - (*b*) *Rigor mortis.*
    - (*c*) Instantaneous cadaveric rigidity.
10. Putrefaction and its processes.
11. Formation of adipocere.
12. Mummification.
13. Summary of signs of death.
14. How long dead.

1. Cessation of Circulation

The cessation of this important function is often regarded as in itself sufficient to determine the reality of death, and rightly so if the observation be made with sufficient accuracy by the stethoscope and over a sufficiently prolonged period. Colonel Townshend was able to throw himself into a condition of pulselessness for nearly half an hour, but, as the stethoscope had not then been invented, it seems highly probable that that instrument would, if continuously applied even for five minutes, have revealed some cardiac sounds, even if feeble and infrequent.[1] Ogston has given details of other well-authenticated cases of apparent voluntary death similar to that of Colonel Townshend.[2]

That the heart may beat even with undiminished vigour up to the last beat, Dr. F. J. Smith was convinced by what he believed to be an almost unique experience.

He was engaged in counting the heart-beats of a pneumonic patient, and had counted some ten or eleven sounds, and was thinking how good and satisfactory they were, but no twelfth sound was heard. The patient had actually died at the moment of listening. *Per contra* he had also listened as the sounds grew feebler and less frequent, while the patient fainted and fell back on the bed apparently lifeless, to return in a few seconds as the faintness passed away.

Life is therefore not incompatible with a temporary suspension of heart-beat, but it is undeniable that the function must be speedily re-established, or death is certain.

To suppose that the important function of circulation can be wholly suspended for several minutes in a human being without destroying life is to set at defiance all physiological experience. The phenomena of hibernation in many animals can have no reference to this condition, for in these a purpose is answered by the feeble state of existence into which they are thrown. While it is natural for such animals to remain torpid during the winter season, or to exist under a feeble exercise of the functions of respiration and circulation, it would be an unnatural condition for a human being, and inconsistent with the maintenance of life. The **auscultatory test**, applied at intervals during half an hour, cannot fail to lead to a satisfactory conclusion.

Bouchut found, in an extensive series of researches experimentally confirmed, that in all cases of apparent death, whether arising from asphyxia or syncope, there is one common character by which they may be distinguished from real death, and that is a continuance of the pulsations of the heart. He established the fact that in the most perfect state of syncope, attended with entire loss of motion and sensation, the contractions of the heart were not really at any time suspended, but simply reduced in force and frequency. In syncope from hæmorrhage carried to the fullest extent, and in cases in which respiration was either imperceptible or carried on at long intervals, the body at the same time having the aspect of a corpse, he was enabled by auscultation to detect the pulsations of the heart, and thus to distinguish apparent from real death. In children born in a state of apparent death and in cases of asphyxia from any cause, in narcotic poisoning, in hysterical and epileptic coma, and in all diseases which have been stated to resemble apparent death, the living has been easily distinguished from the dead body by the continuance of the heart's action. This was feeble, and took place at intervals, but it was always sufficiently marked to enable a professional man to distinguish a living from a dead body.

It has been considered important to define, if possible, the periods at which, after the entire cessation of the heart's action, a person might be pronounced dead. The highest degree of Bradycardia (or slow-beating heart) recorded is ten or twelve beats per minute. If, therefore, no sound of the heart is perceived during an interval of *five minutes*, a period which is many times as great as that which observation warrants, death may be regarded as certain in circumstances which to a medical man otherwise make it probable.

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[1] Townshend died some nine hours after a performance of the experiment, and nothing pathological was found on a *post-mortem* examination.

[2] "Lect. on Med. Jur.," pp. 364, 368.

This test has been objected to (1) because the heart itself may, like other muscles, be in a state of apparent, and not real, death, and (2) because the pulsations and sounds of this organ may not always be appreciable to the ear, even when aided by the stethoscope.

In support of these objections, it is stated that the vitality of new-born children has been restored in whom no pulsation whatever could be discovered for a period of fifteen to thirty minutes after birth. In one instance a child was revived, after *twenty minutes* of apparent death, by insufflation of the lungs, although during that time no pulsation could be heard or felt. Numerous cases of resuscitation by massage of the heart and by other means after the heart has stopped beating have been recorded.[1]

If, however, the medical man is not satisfied with auscultation, there are other tests which he may apply. One is to **tie a piece of string** or other ligature round a finger moderately tightly, and notice if, in the course of a few minutes, the finger swells on the distal side of the ligature. If no swelling whatever takes place, it is an additional proof that circulation has ceased, while if the end does swell it is a proof that circulation is still going on, though possibly only feebly, as by emptying of the arteries after the heart has ceased to beat. The second additional test should only be resorted to in extreme cases, as it involves **opening a small artery.** When this is opened the character of the blood flow must be noted. It will be jerky if the heart is still beating, continuous, like the flow from a vein, if the heart has ceased, and the bleeding is merely from the elastic contraction of the artery ; if no flow whatever is obtained, death is certain in the special circumstances of the experiment. Icard's test which consists in the subcutaneous injection of a small quantity of a solution of fluorescin with bicarbonate of sodium should be mentioned. If circulation is still proceeding, however feebly, a greenish-yellow discoloration of the surface of the body is soon produced. This test should only be applied by daylight, as the colour is difficult to appreciate by artificial light. There are several other so-called tests of death, but no further attention need be paid to them.

2. Cessation of Respiration

This, like the cessation of the heart-beat, must be *entire and continuous* to constitute any approximation to a test of the reality of death. It may cease for a very short period without death ensuing in the following conditions, none of which is likely, however, to give rise to any difficulty in connection with real or apparent death:—(*a*) As a purely voluntary act. Two minutes seems here to be the outside limit, which experience shows cannot be exceeded ; even expert sponge-divers, who have spent their lives at the occupation, cannot remain under water without artificial contrivances for a longer time than two minutes. (*b*) In the peculiar condition of respiration known as Cheyne-Stokes breathing the limit of the apnœic interval has never been known to exceed some fifteen to twenty seconds. In (*c*) the apparently drowned and (*d*) new-born infants the act of respiration, as performed by the mechanism of the body itself, is frequently absent for long periods, and doubts often occur as to whether life really remains in the body. It is quite possible that in some of both classes apparent passes into real death owing to the want of perseverance in artificial aids to establish natural breathing, but the subject is more fully discussed elsewhere (p. 227 and Section on " Drowning "). After powerful electrical shocks there may be every appearance of death, but continuous artificial respiration may cause natural breathing to commence after long periods. It has not very much bearing on the reality of death in such cases as are here under discussion, in which it may be laid down that three and a half minutes is the extreme limit during which respiration may cease and yet life be maintained.

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[1] Young, N., *B.M.J.*, 2: 230, 1935.

Tests for the Continuance of Breathing. (1) The movements of respiration can hardly be overlooked by any person who exercises due care, but for the purpose it is necessary to have both the chest and the abdomen exposed to view. (2) The stethoscope must be carefully and continuously applied to the upper part of the lungs in front or to the larynx itself, by which means very slight currents of air may be detected. This test alone is practically sufficient, but if doubt still remain (3) a feather may be held in front of the mouth, when even the slightest breath will move some of the smallest divisions of it, or (4) a piece of cold bright-looking glass may be held there, the surface of which will be dimmed by the moisture deposited upon it from the breath if even the slightest respiration is continuing. (5) A glass of mercury or other bright reflecting surface may be placed on the chest, and the reflection of a light from it be focussed on a fixed spot. This image will be seen to move if respiratory movements of the slightest degree are still continuing.

3. Cooling of the Body

One of the most striking characteristics of life is the power which the body of warm-blooded animals has of retaining a temperature far above that of the medium in which it is ordinarily placed. Notwithstanding that the body is constantly subjected to the same laws of cooling as all other heated solids, *i.e.*, by radiation, conduction, and convection, the supply of heat internally is so constant and well regulated as to counterbalance exactly the loss which is experienced. When life is extinguished, the body gradually loses the heat which it possessed at the moment of death, just as so much inert matter artificially raised to the same temperature. The normal temperature of the interior of the body in health is about 98.4 F. (36.8 C.). Of all the changes that occur in the dead body that of cooling to the temperature of its surroundings is the one about which we have the most knowledge. Its rate, with very few exceptions, obeys laws which are comparatively well understood, and it is perhaps the most reliable change by which to calculate the time that has elapsed since death.

In order to understand the process it is first necessary to give a brief outline of the sources of heat in the living body, the usual modes of loss, and the mechanisms by which the two work in harmony to maintain during life a constant mean temperature in the human body.

We can then more easily appreciate the rules and exceptions which experience and observation have afforded us.

(i.) *Sources of Heat.* There is only one ultimate source of all the heat in the body, and that is the chemical process—probably always one of oxidation—by which complex bodies are reduced to simpler substances. This process goes on in all the organs and tissues of the body, but principally in the muscles, in which the energy set free is largely converted into heat. By means of the blood circulation the heat produced in any one part is convected to other parts.

(ii.) *Loss of Heat.* The main channels by which heat is lost from the body are (*a*) from the skin by radiation, conduction and the evaporation of sweat; (*b*) from the lungs by warming the expired air and saturating it with aqueous vapour (this is vaporised on the alveolar surface of the lungs at the expense of body heat); (*c*) by the voidance of warm excreta, urine and fæces; and (*d*) to some extent by the converse process to oxidation, *i.e.*, by building up new complex bodies out of simpler ones.

(iii.) *Regulation of Heat Loss.* This is almost entirely brought about by vascular arrangements, which in turn are controlled by the nervous system, the whole mechanism being so adapted to the needs of the body that when the muscles produce an excess of heat the blood carries this excess either to the skin or lungs, where it can be disposed of, or to other organs that require more heat than they are producing.

(iv.) *Cellular* v. *Somatic Death.* When a muscle or gland has, by virtue of the circulation of nutritive materials in the blood, become fully charged with the substances it needs for its own life and for the discharge of its own functions, it can continue to live and discharge certain of those functions—so far at least as the process of oxidation is concerned—without the usual nerve and other stimuli under which it is accustomed to act. This may be spoken of as cellular life, which may continue for some little time after somatic death, or death in the ordinary sense of the word, has occurred.

(v.) *Co-efficient of Differences.* When two substances at different temperature are brought into such relationship that either can give or receive heat to or from the other, then the greater the initial difference between their temperatures the more rapidly will the process of equalisation of the temperatures take place at the commencement of the experiment, and the less the difference the more slowly is equilibrium brought about. Loss and gain are a function of the difference between the temperatures and not of their absolute values.

(vi.) *Conduction of Heat through the Tissues.* All the tissues of the body may be said to be indifferent or bad conductors of heat, but fat is especially so.

(vii.) *Action of Microbes.* These microscopic bodies are chiefly concerned in decomposition (*q.v.*), and it is well known that an evolution of heat is associated with the onset of decomposition, as may be readily observed in decaying dungheaps, etc., which are always some degrees above the temperature of the air while decomposition is proceeding. That they can thus act in delaying cooling is therefore possible.

It is obvious that when death ensues, and respiration and circulation cease, and the muscles remain inactive, the sources of heat are lost, and the amounts available from still continuing cellular life in organs can only escape by simple conduction. Similarly the only means of loss of total heat is by conduction to the surrounding objects, including air and water, which may also be in motion and thereby convect heat from the body:

A caution must be here inserted with regard to the exact meaning of the cooling of the *body*, and how it is to be determined. It is customary to judge of the coldness by placing the hand on the skin : this is very fallacious, inasmuch as it depends, first of all, upon the warmth of the observer's hand—a corpse may feel cold to a warm hand and warm to a cold one ; and, secondly, the warmth of the skin of a corpse is not a good criterion of the warmth of the viscera.

Among cases observed at Guy's Hospital it was remarked that in several a high temperature was retained by the viscera for a long period after death. In two instances a thermometer indicated in the viscera a temperature of 76° F., in one instance seventeen and in the other eighteen hours after death, the temperature of the air being comparatively low (49° F.), and the surface of the body cool. In a third instance, ten hours after death, while the surface of the abdomen had a temperature of 65° F., the interior was 85° F. In all observations on the temperature of the dead body a thermometer should, if possible, be employed. This may be applied to the skin of the abdomen, or to the armpits ; but for determining the temperature of the interior of the body the bulb should be introduced into the rectum.

With this caution we are now in a position to appreciate the factors which are likely to promote or retard the cooling of the body. Thus :—

COOLING IS DELAYED BY—	COOLING IS HASTENED BY—
Connected with the Body	
A. Acute pyrexial disease and strychnine poisoning as the cause of death, because of (*a*) the increased quantity of heat that has to be dissipated ; (*b*) the continuance for a time of microbic action if the disease is of microbic origin.	A. Chronic apyrexial illness, especially if associated with wasting.
B. Sudden death in healthy subjects.	B. Lingering death.
C. Middle age, because here we have the most favourable proportions between subcutaneous fat and superficial area (for cooling by radiation) to actual bulk.	C. Extremes of age. In babies there is a greater superficial area compared with the weight. Old age is usually associated with absorption of subcutaneous fat.
D. Obesity, because of the bad conduction of heat by fat.	D. Leanness, because of absence of the buffer of non-conducting material.

COOLING IS DELAYED BY—	COOLING IS HASTENED BY—
Connected with Surroundings	
E. Clothes on the body, because these, like fat, are bad conductors of heat, not only through their material, but also because of the air between their fibres.	E. Unclothed body.
F. Want of access of air, especially air in motion. It is by the movement of air round a body that the actual convection of heat is carried out.	F. Access of air.
G. The smallness of room or space in which the body is left. This is merely complementary to F.	G. Large room, bulk of air to be warmed.
H. Material on which it is laid. This, if soft, practically clothes the body and prevents access of air. If it possesses heat of its own, as, for instance, dungheaps, etc., the cause of delayed cooling is obvious.	H. Material. If the body lies on a hard substance, free access of air is allowed.
I. The actual temperature of the air. This needs no comment. The warmer the air, obviously the slower the cooling.	I. Coldness of air.
J. A body on land, as opposed to one in water, cools more slowly.	J. Water. A body left in ordinary water, and especially in running water, always cools more rapidly than one left on land. The reasons are not far to seek: (*a*) large masses of water under ordinary circumstances are actually a little colder than the air; (*b*) the enormous specific heat of water, which thus enables it rapidly to abstract and dispose of large quantities of heat, and yet to keep at a lower temperature than the body from which it is gaining heat. If the water is running in large bulk, so as to be comparatively uninfluenced by the sun, the above reasons hold with still greater force.

The alleged effect of loss of blood in accelerating the cooling of the human body when death has occurred suddenly from hæmorrhage has little or no foundation in fact.

A healthy man, *æt.* 47, died suddenly from hæmorrhage. A ligature had been placed on the axillary artery in consequence of an accident ; this gave way, and about four pounds of blood were lost. Four hours after death the shoulders, chest, and abdomen of the deceased were quite warm. The skin of the abdomen had a temperature of 84° F. ; eight hours after death the temperature was 80° F., and the arms and legs were not rigid. The conditions under which this body was exposed were favourable to rapid cooling ; it was placed in a shell with a shirt loosely over it, and the temperature of the deadhouse was 38° F.

The only physical difference which it would be likely to create would be by the reduction of the amount of hot fluids in the body. In the above case, the loss of four pounds of blood made no appreciable difference in the rate of cooling.

Taylor made observations on the cooling of the dead body in one hundred cases at Guy's Hospital by taking the surface temperature of the bodies at four different periods. The following table of his results have a certain interest but there are so many factors to be considered that no general rate of cooling can be postulated :—

	First period, 2 to 3 hours.	Second period, 4 to 5 hours.	Third period, 6 to 8 hours.	Fourth period, 12 hours.
Number of observations	76	49	29	35
Maximum temperature of the body . .	94° F.	86° F.	80° F.	79° F.
Minimum temperature of the body . .	60° F.	62° F.	60° F.	56° F.
Average temperature .	77° F.	74° F.	70° F.	69° F.

It may be accepted as a general fact that the body is not cooled to approximately the temperature of the surrounding medium, air, in less than from twelve to twenty-four hours. Some writers on forensic medicine assume that the body cools at the rate of 1° F. per hour. But the rate of cooling is nearly proportional to the difference of temperature between the body and the surrounding medium, so that the rate of cooling becomes slower as its temperature approximates to that of the surrounding air (*vide* rule v., *supra*). Soon after death a body may lose temperature at the rate of 4° or 5° F. per hour, and after the lapse of twenty hours may not lose so much as 1° F. of temperature per hour. Burman,[1] found the average rate of cooling to be 1.6° F. per hour.

If the circumstances under which a body is exposed are favourable to the loss of heat, it may be found cold to the hand in eight or nine hours after death, but if a thermometer is introduced into the anus it will be found to record a raised temperature almost invariably. In a medium air temperature (50° to 60° F.) the clothed adult body takes about twenty-four to thirty hours to cool to the temperature of its surroundings.

Such are the commonly observed facts in the cooling of the body, but there are certain exceptional cases of which the explanation is not quite clear. There are numerous authentic observations which show that heat may be sometimes long retained by the dead body, both on the surface as well as in the cavities.

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[1] *Edin. Med. and Surg. Jour.*, 1880, 25 p. 993.

It is well recognised that not only may the body retain its heat after death for an exceptionally long time, but that the **temperature** of the internal parts **may actually continue to rise for an hour or two** after death. The explanation is not so mysterious as used to be thought, for, on the one hand, the influence of micro-organisms producing a pyrexial death—*e.g.*, hyperpyrexia in septicæmia—need not be assumed to cease at once simply because the person has died, nor, on the other hand, need we assume that oxidation in the tissues must at once cease with somatic death, and this oxidation in pyrexial disease is raised to what may be called conflagration pitch and has probably upset the heat-regulating mechanism before death.

Increase of temperature after death has been referred to putrefaction ; but it can occur soon after death, and before rigidity sets in. Some of the cases reported by Wilks and Taylor also show that it may take place independently of putrefaction. Dowler has noticed it as a common occurrence, in a warm climate, in the bodies of persons who have died from yellow fever. The heat of the body, according to him, continues to increase for several hours after death ; and in one case, after six hours, he found the armpit to have a temperature of 100° F., and the abdomen one of 103° F. In another, the temperature of the armpit during life being 100° F., it was found that in three hours after death the temperature of this part had risen to 104° F. ; in a third case, a similar increase was observed in thirty minutes. The highest *post-mortem* temperatures were observed in the thighs. Thus, in a case in which the armpit had during life a temperature of 104° F., in ten minutes after death it indicated a temperature of 109° F., and in fifteen minutes after death the thigh gave a temperature of 113° F. When the maximum, which is variable in different bodies, has been attained, the body gradually undergoes the cooling process observed after death. In a death from epidemic cholera the dead body reached its maximum temperature of 109° F. in about an hour and a half. These observations may serve to explain that in some exceptional instances a dead body may retain for many hours a temperature as high as, or higher than, that which is usually found in the living.

Cooling of the body is important not only as a sign that death has taken place, but also inasmuch as it gives valuable information about the time of death. It is advisable therefore, in all cases, to record the rectal temperature of the body and of the medium in which the body is found.

4. Insensibility and Loss of Power to Move

These are concomitants of death, and must therefore be noted in a complete exposition of the "signs of death," but they certainly may be, and are, found in cases of death which is only apparent, and not real. Thus in the apparently drowned not only are they found, but perceptible heart-beats or respiratory movements are also absent for a time, in cases that ultimately recover entirely, a fact again calling for prolonged efforts at resuscitation. The same phenomena of insensibility and loss of power to move are witnessed in prolonged fainting attacks, in apoplexy at times, in epilepsy, in trance, catalepsy, and the cases already mentioned of prolonged sleep ; in fact, these two signs of death have by the laity had a very undue weight thrown upon them without attention being paid to the other more certain signs.

5. Changes in the Skin

After death the skin is observed to become pallid and waxy-looking, owing to the absence of all circulation. In some parts as the body cools it becomes covered by livid discolorations (cadaveric hypostases). One of the most striking changes in the skin is its **loss of elasticity.** In the living body, if any part of the surface be compressed, the skin will readily return to its original form on removing the pressure. Thus in a doubtful case, a flatness of those parts which have been allowed to lie upon an even surface may be regarded as a sign of real death, provided the other concomitant changes are observed.

There is another condition of the skin in the dead which calls for notice, *viz.*, **its opacity.** If the hand of a living person is held before a strong light, it will be found to be translucent and of a deep red colour from the translucency allowing of the red colour of the circulating blood being seen through the skin. The hand of a dead person is opaque, owing to the opacity of the skin. In applying this test, we must remember that a horny or hardened state of the cuticle, or a diseased condition of parts, may interfere with the translucency in the living subject; it is always better seen in the young and in those whose hands are thin.

In the living, light thus passing through the skin will actually display the spectroscopic appearances of blood if passed through a spectroscope. Such an experiment fails if attempted with a dead body.

6. Action of Heat on the Skin

As a test of the reality of death this is rarely required, but the matter assumes more importance when the law demands an answer to the question, whether burns found on a dead body were inflicted during life or after death. This question is discussed under the heading of "Burns" (*see* below); only a very brief notice will be here introduced. Thus if a person has remained apparently dead for, say twenty-four hours—and it is only in such extreme cases that the test can be of any use—the heat of boiling water may be applied to a very limited portion of an arm or a leg; if death be real only a dry blister will be produced. The epidermis may be raised considerably if the heat be applied for some minutes, but on pricking it no fluid, but air only, will escape, and no redness in the surrounding skin will be produced, thus showing that circulation has ceased for some time. If a blister on the skin, produced by the application of a flame, contains a serum rich in albumen, whilst the cutis vera, after the cuticle has been removed, presents a reddened appearance, more especially if, after a short interval, a deeply injected red line forms around the blister, absolute evidence is afforded of the vitality of the part to which the heat was applied, and exceedingly strong confirmatory evidence of the life of the person.

If a blister, formed by the application of flame to the body, contains air, or a little non-albuminous serum merely, the cutis vera after the removal of the cuticle appearing dry and glazed, more especially if, after an interval, no red line becomes visible around the blister, the evidence is absolute that the part so treated is dead, whilst the presumption is strong that the person himself is dead.

This is a sign of death which affords a certain amount of corroboration to the more important ones, and which also has a certain value as an aid in determining the time which has elapsed since death.

7. Changes in and about the Eye

(*a*) *Loss of Corneal Reflex.* This is common to death and to other forms of deep insensibility, *e.g.*, general anæsthesia, apoplexy, uræmia, epilepsy, narcotic poisoning, etc., etc. It is also lost in local anæsthesia by cocain, etc.

(*b*) *Clouding of the Cornea.* This affords stronger presumption of death, but as it may occur in certain diseases, such as cholera and wasting diseases, before life is extinct, it is unreliable. Moreover, in some cases, the cornea remains clear and translucent for some time after death without any obvious cause.

(*c*) *Flaccidity of the Eyeball.* This occurs soon after death, but may be noticed in certain cases during life.

(*d*) *State of the Pupil.* The iris contains a large proportion of muscular tissue which during life enjoys, in common with all muscles, a certain " tone " ; this tone is rapidly lost after death, and the iris dilates somewhat into a condition of equilibrium. Hence, if there are no circumstances interfering with this action, as in poisoning by opium, etc., a dilated pupil becomes a minor sign of death. The power to react to light is soon lost after death, but it must not be forgotten that it may be lost during life, as in apoplexy, uræmia, tabes dorsalis, etc. The action of drugs—atropine or eserine—continues probably for an hour, or somewhat longer, after death. Their application to an eye under such circumstances is free from all risk, and may, therefore, be made when this form of evidence might be required to confirm the reality of death. No conclusion can be drawn from the width of the pupils in death as to the diameter which they presented at the latest period of life. This statement is of some practical importance in reference to the *post-mortem* appearance in cases of *alleged* narcotic poisoning.

8. Changes connected with the Blood

A. Coagulation. It is here unnecessary to enter into the physiological reasons for the coagulation of the blood. We must accept the fact that when retained in its original vessels it coagulates very much more slowly than when it has been removed to a receptacle of any sort, or has come in contact with what for it is foreign tissue, *i.e.*, blood effused into the tissues or cavities of the body clots fairly rapidly.

The practical point is that the blood coagulates in most cases after death, but at a variable time after the cessation of the heart's action. When blood is removed from the living body, coagulation commences in a few minutes. In the dead body, it does not commence until the blood begins to die and cool. Hence the fact of coagulation on removal does not prove that the person is living. When a body is examined eight or ten hours after death it is not unusual to find the blood which may have flowed from it as a liquid forming a firm clot ; and that which is effused into the chest during the examination often forms after some time a very firm coagulum. It has been stated that the blood of persons killed by lighting does not coagulate, but this statement is erroneous. Certain diseases, such as pneumonia, influence the rapidity of coagulation of the blood, and it is well known that in rapid death from certain vegetable and animal poisons, and in asphyxia, the blood remains fluid and of a darker colour than normal.

When the blood has once coagulated, there must be an arrest of circulation, and although it *does* become fluid again, this is only under the influence of putrefaction, and it does not thereby recover a coagulating power. One of the great characters of blood effused from a *living* body is, that it coagulates speedily after its effusion. For further points of difference between living and dead blood, *vide* "Tests for Blood."

B. Post-mortem Bleeding. After death the arteries contract, and by their contraction empty the blood in them into the capillaries and veins, provided that it has not coagulated too soon ; the heart having ceased to beat and the veins being much weaker than the arteries, the blood remains in the veins in a stagnant condition, and probably still uncoagulated. In these circumstances, if a vein has been wounded before death or even if it be opened after death it may bleed *post-mortem* and give rise to a suspicion that the wound was produced before death. The matter will be again referred to under "Wounds."

C. Post-mortem Hypostases. The phenomenon of *post-mortem* hypostasis is due to the fact that while the blood is liquid it obeys the universal law of gravitation and sinks to the lowest available part, and furthermore the heavier parts of the blood—*viz.*, the red corpuscles—have a tendency to settle first. This is also a point of some importance in judging of the position in which a body has lain during the hours succeeding death (*vide post* under "Inferences"). The phenomenon of hypostasis as seen by the naked eye consists in the appearance in the skin of the body of discoloured patches—slaty blue or reddish or dark red-black in early stages, varying to bright red or coppery, or even green, when decomposition has advanced—to which many different names have been applied (*post-mortem* hypostases, subcutaneous hypostases, cadaveric lividities, suggilations, vibices, *post-mortem* stains). Of these names *post-mortem* hypostases or simple hypostases is the best, founded as it is on the basis of the universally accepted theory as to the method by which they are produced. These appearance have often been mistaken for the effects of violence applied during life, and serious mistakes have thence arisen. Innocent persons have been accused of murder or manslaughter, and have been tried on charges afterwards proved to be groundless. Christison refers to two cases, in one of which two persons were convicted, and in the other three narrowly escaped conviction, upon a mistake of this kind.

The Time when Hypostases occur. They generally commence to form within a few hours of death. At first they form patchy or mottled areas, but within about twelve hours they are complete in their permanent form by coalescence of the smaller areas. Disease doubtless plays some part in influencing the time of their appearance, for the precise time required for coagulation, whether in or out of the body, depends upon imperfectly understood factors of which the disease from which the person has been suffering is one. Consequently the time of the formation of *post-mortem* hypostases, depending as it does in great measure on the time that the fluidity of the blood lasts, may vary considerably according to the cause of death. Thus in acute pyrexial diseases, in which the blood often coagulates rapidly, coagulation may precede the actual moment of death, and in fact be the cause of death. Hence cadaveric hypostases in such cases will be of limited extent and possibly slow in making their appearance. Conversely in other diseases, such as phthisis, and acute asphyxial conditions, in which the blood coagulates slowly, cadaveric hypostases will be extensive and rapid in appearance. Hence disease must be noted as bearing on the matter, though the cases in which evidence on the point is required are more commonly those in which healthy persons have been killed by violence, homicidal or otherwise, and the question of disease is not raised.

They are of Constant Occurrence in all Bodies. It has been stated that they do not occur in the bodies of those who have died from loss of blood; this is certainly not in accordance with facts. To prove a universal negative is notoriously difficult, if not impossible; but we have been able to find them in all such cases. It is true that they have been in some cases inconspicuous, but they have been there all the same. They have been in general the more conspicuous the less pyrexial the death, though it is impossible to lay down any other rule than the one that they have never been absent in any of the bodies that we have examined.

They occur in the Viscera as well as in the Skin. This is important to remember, for the condition is liable to be mistaken for a congestion occurring during life or for one that has been the actual cause of death. Thus they are found in the veins of the pia mater in the posterior fossa of the skull, where they may be mistaken for the congestion of asphyxia or for that attendant on a meningitis. From the former it is very difficult to distinguish them except by the fact that if the congestion be due to asphyxia it is likely to cause actual turgidity of the veins and to be equally well marked over the hemispheres in the middle and anterior fossæ as well as the posterior. In hypostasis there will be no observable turgidity, and the condition of fulness will be in the lowest fossa (posterior in a supine—the usual—position of a corpse, anterior in a prone—the unusual—position). From the latter they are easy to distinguish by the absence in hypostasis of any pus or sticky serum: in inflammation one or both of these will be distinctly noticeable; moreover, in simple hypostasis the pia mater will have a clear glistening appearance which will be absent if inflammation has been present. Congestion without inflammation and simple hypostasis may be confused by one who is unaccustomed to making autopsies.

During life congestion may be of two kinds: (1) active or arterio-capillary-venous, which is equivalent to, or is the visible indication of, inflammation, or of blushing or flushing; (2) passive, which is a mere overfilling of veins, due either to want of a suction power in front or a driving power behind. After death the signs of active congestion are likely to diminish, and those of passive or simple filling of veins to increase, and it is the latter which it is so difficult to distinguish from inflammation in certain viscera.

In the dependent parts of the lung hypostasis is always found, and is liable to be mistaken for the early stages of pneumonia. The diminished resistance offered to penetration of the finger through the substance of the lung is suggestive; but it must be admitted that it is not always easy even after much experience to discriminate between a mere hypostasis and a condition due to active *ante-mortem* hyperæmia, especially if the latter be combined, as it so often is, with an escape of blood out of the capillaries. The greatest caution must be exercised in expressing an opinion in a case that is doubtful from the absence of other distinguishing features, such as a similar condition in non-dependent parts, definite valvular disease of the heart, or definite bronchitis. The most intense hyperæmia of the lungs is seen in some cases of brain disease. A miscroscopic section should be prepared in any case where there is the least doubt of the pathological condition.

In dependent parts of the stomach and intestines hypostasis is liable to be mistaken for inflammation. In the absence of definite lymph on the peritoneal surface, or pus, or actual hæmorrhage, the best distinguishing feature lies in the fact that on stretching the viscus the continuous black lines (the veins filled with blood) will break up into isolated lengths, with gaps between them if the condition is due to hypostasis ; they will remain unbroken if inflammation is present.

Hypostases may resemble Marks of Violence (**Bruises**). This is true on a superficial examination, but there are many definite points of distinction, which may be tabulated thus :—

Bruise	*Hypostasis*
1. Below the epidermis in the true skin in small bruises or extravasations, below this in larger ones, and often much deeper still. The reason is obvious, *viz.*, that the epidermis has no blood-vessels to be ruptured.	1. In the epidermis or in the cutis, as a simple stain or a showing through the epidermis of underlying engorged capillaries.
2. Cuticle probably abraded by the same violence that produced the bruise. In small punctures, such as flea bites, this is not observed.	2. Cuticle unabraded, because the hypostasis is a mere sinking of the blood, and therefore there is no reason for abrasion.
3. A bruise appears at the seat of and surrounding the injury. This may or may not be a dependent part.	3. Always in a part which for the time of formation is dependent, *i.e.*, at a place where gravity ordains it.
4. Edges not sharply defined, because the extravasated blood soaks irregularly beyond the actual source of extravasation in the lines of least resistance to soakage or pressure of extravasation.	4. Edges sharply defined ; simply indicates the level of the fluid still contained in the vessels.
5. Often elevated, because the extravasated blood and serum of subsequent inflammation force apart and elevate the tissues.	5. Not elevated, because either the blood is still in its pre-existent vessels or at most has simply soaked into and stained the tissues.
6. Incision shows blood outside the vessels. This is the most certain test of difference, and can be observed even in very small bruises.	6. Incision shows the blood still in its vessels ; and if any oozing occurs drops can be seen issuing from the cut mouths of the vessels.

7. Colour variegated. This is only true of bruises that are some days old, or at least one day; it is due to the changes in the hæmoglobin produced by decomposition under the influence of living tissues, and indicates that the bruise was made during life.	7. Colour uniform. The well-known changes of colour (green, yellow, etc.) produced in blood extravasated into living tissues would appear not to go on in dead tissues, at least with the same regularity and rapidity, and hence are not observed in cutaneous hypostases.
8. If the body happens to be constricted at, or supported on, a bruised place, the actual surface of contact may be a little lighter than the rest of the bruise, but will not be white.	8. In a place which would otherwise be the seat of a hypostasis pressure of any kind, simple support (the wrinkling of a shirt or necktie, garters, etc.) of very slight degree is sufficient to obliterate the lumen of venules and capillaries, and so to prevent the entrance of blood; hence are produced white lines or patches of pressure bordered by the dark colour of a hypostasis. Marks of flogging, strangulation, etc., are thus sometimes simulated.

Microscopic sections of the part should be prepared in any case of doubt.

These points are sufficient, if carefully noted, to decide the question of whether a given mark was due to violence or not; but it must be admitted that feebleness of circulation in the aged, and sometimes the effect of exposure to cold, may resemble the effects of violence. Such marks are, however, practically always found on parts, such as the ear, the shins, the fingers, or toes, where the circulation is comparatively poor, and where experience leads to their expectation.

There is a case on record of a man who died on board the *Dreadnought* hospital ship where the colour changes commonly found in a bruise were seen in a hypostasis.

The subject of this case, *æt.* 33, died suddenly from disease of the heart. Just before death the deceased had been auscultated, and no marks then existed on the skin. The body was examined, after about eighteen hours, and then it was found to present, in detached places, patches of discoloration, varying in size from small spots to areas several inches in diameter. Although closely simulating bruises or marks of violence during life, a slight examination showed that they were owing to hypostasis, because those parts of the back and limbs which were not compressed by the surface on which the body of the deceased was lying were the only parts discoloured. The calves of the legs, the loins, and the back, which bore the pressure, were white. On cutting into these patches, the layers of the skin, as well as the tissues beneath, were throughout reddened by blood, and small rounded semi-coagulated masses oozed out on slight pressure.

These features somewhat resembled those produced by violence on the living body; but there was another, and an unexampled circumstance, in which the resemblance to *vital* ecchymosis existed. Around many of the patches there was a wide border, or zone, of a pale straw colour, with various shades of green and blue, precisely similar to those which are seen in the gradual disappearance of an ecchymosis from the living body. By most medical jurists it has been hitherto considered that the zones of colour are peculiar to vital ecchymosis, and are never seen in an ecchymosis produced after death.

The occurrence of this case illustrates the great need for caution in framing general rules for medical-legal practice. If the body of this man had been found lying dead and exposed on a high-road, and it had been proved that another man had been seen quarrelling with him, the survivor might have found himself in a very difficult position. This kind of ecchymosis could have been distinguished from that of violence during life only by the unruffled state of the skin and the slight effusion of blood compared with the extent of discoloured surface. The formation of the coloured zones around some of the patches of lividity was fully explained by the fact of the man having laboured under general dropsy. The effused serum here acted upon and diluted the blood as it exuded from the vessels and diffused it around. The evidence seems so conclusive that the case must be accepted notwithstanding its unique character.

When decomposition commences the blood shares in the process, and hypostases undergo some changes in consequence : they may become of a coppery red colour, and may show even large veins running across them of a similar colour, or they may become bright or dull green ; at the same time the blood has again become liquid, and soaks through the dead tissues as it would through any other permeable material. Hence it follows that as putrefaction advances it becomes progressively more diffiult to distinguish between a bruise and a hypostasis, for the crucial test of finding blood actually effused from the vessels into the tissues becomes more difficult of appreciation. The difficulty with the other corroborative tests is perhaps more academic than practical, but it is nevertheless well to exercise caution in giving an opinion when the body is much decomposed.

A question connected with hypostasis was raised in the trial of one Reid, namely, whether this cadaveric lividity *always* precedes cadaveric rigidity or not. Rigidity is not in general strongly manifested until the body is cold ; hypostasis takes place while the body is cooling and the blood is liquid. The occurrence of rigidity depends on the time at which muscular irritability is entirely lost, but *post-mortem* discoloration of the skin is connected only with fluidity of the blood ; hence cadaveric lividity begins to develop soon after death, and continues to increase until the blood is coagulated, when its formation is arrested until the blood again becomes liquid. As it has now been clearly proved that rigidity affects the heart and coats of the arteries before rigidity of the voluntary muscles manifests itself, it is highly probable that in the contraction of these tubes the blood is forced at first through the capillaries into the venous system, and afterwards, from want of sufficient power of propulsion, it stagnates unequally in these vessels, producing hypostases. The question then must be answered in the negative.

9. Changes in the Muscles

The first effect of death from any cause is in most cases a general relaxation of the whole of the muscular system. The lower jaw drops, the eyelids lose their tension, the limbs are soft and flabby, and the joints are quite flexible. In from three to six hours after death, and generally while the body is in the act of cooling, the muscles of the limbs are observed to become hard and contracted, the joints stiff, and the body firm and unyielding. This pecular condition is known under the name of cadaveric rigidity or *rigor mortis*.

The muscular tissue passes through three stages in a dead body. (1) It is flaccid but contractile, still possessing life, although, as will be seen hereafter, muscles contracted by living force in the act of dying do not necessarily become relaxed in death; (2) it becomes rigid and incapable of contraction : it is then dead ; and (3) it once more relaxes and does not retain its power of contractility : it then begins to putrefy. The first stage defines the duration of muscular irritability, the second stage that of cadaveric rigidity, and the third that of the commencement of putrefaction.

A. The Period of Irritability. We may now consider the period of irritability of the muscles in its medico-legal aspects. In order to determine the reality of death, it has been proposed to test the irritability of the muscles by the application of an electric current. If a voluntary muscle does not contract under the application of this stimulus, the inference is that the person is dead ; but if it should contract under these circumstances, it furnishes no proof that the person is living, in the ordinary meaning of the word. The cardiac and other involuntary muscles, which are readily affected by a mechanical stimulus soon after death, lose their irritability or power of contraction, even under a galvanic current, much sooner than the voluntary muscles.

Contractility of the voluntary muscles would, therefore, prove either that the person was living, or that the body was in the first stage of death. All the muscles do not retain this irritability to an electric stimulus for the same length of time, nor do they all lose at once their susceptibility of contraction. The voluntary muscles retain their irritability on the average about three hours. One degree of stimulus may excite them, while another may not.

It has been shown by numerous experiments on the recently dead body that *post-mortem* contractility may be excited by slight blows on the muscles given with the hand or any weapon.

It is a fact that the blood has no appreciable influence upon the *post-mortem* contractility of the muscles, for when the limb was severed from the trunk, and drained of its blood, contractions as the result of slight blows were observed in forty-three cases. The contractions were in many cases so forcible as to cause a heavy weight to be lifted by the limb in which they occurred. Spontaneous movements in a corpse have been seen after death from cholera, and the same may take place after death from yellow fever and other diseases. It is well known that the changes in the position of the limbs of bodies sometimes observed after death, which have given rise to tales of premature interment, may be explained by the occurrence of spontaneous *post-mortem* contractions, depending on the retention of muscular irritability. Haller endeavoured to lay down the order of cessation of this irritability in different muscles after death. Many physiologists since his time have also occupied themselves with this question. Haller found that it varied according to the kind of stimulus employed. He was of opinion that the irritability of the heart was excited by mechanical agents for a longer period than any other part of the muscular system, a circumstance which was supposed to account for the reports of persons having been dissected alive to be found recorded in some works on medical jurisprudence, an accidental puncture by the knife or forceps having given rise to contractions of this organ. But, to admit this explanation, we must suppose that the body was inspected within one or two hours after death.

Nystem concluded from his observations that the successive disappearance of muscular irritability in the bodies of decapitated persons took place in the following order : (1) the left ventricle of the heart, (2) the stomach and intestines, (3) the urinary bladder, (4) the right ventricle, (5) the gullet, (6) the iris, and (7) the voluntary muscles of the body.

B. Rigor Mortis. After the period of irritability has passed there is a gradual stiffening of the muscles together with a certain amount of shortening of the fibres, this condition being known as *rigor mortis.*

Every muscle in the body, voluntary and involuntary, takes part in the process, including the musculature of the heart and vessels, the platysma of the skin, the erector pilæ muscles (contraction of which leads to cutis anserina), and the dartos leading to retraction of the penis. The onset of rigor is occasioned by the same factors which cause contraction in life, namely by the formation of acid substances in the muscle plasma, and anything which leads to an increase in the products of metabolism before death will naturally lead to a more early production of rigor.

When *rigor mortis* occurs, there is a considerable increase in the amount of lactic acid and phosphoric acid found in the muscle juice.

The gradual liberation of these acids by the breaking down of lactacidogen leads to a change in the physical condition of the muscle fibre. It is improbable that the early stiffening of rigor is due to a direct coagulation of the muscle proteids by the acid, for rigor commences before the production of acid has reached the requisite concentration.

Eventually, no doubt, acid is produced in sufficient amount to cause actual coagulation of the muscle proteids. It has been pointed out by Hopkins[1] that if abundant oxygen is supplied and the muscle kept at 0 C. to slow down the chemical changes, there is no accumulation of acid, no shortening and no rigidity. We may take it that the production of acid from glycogen is the first step in the induction of *rigor mortis.* The next step leading to shortening, stiffening and opacity of the muscle fibres is due to the action of this acid on the muscle proteids. The process in its initial phases is essentially similar to muscular contraction in life, but is not reversible.

There are two muscle proteids concerned : myosin (para-myosinogen) and myogen (myosinogen). The former is a globulin, and is coagulated by heat at 44° to 50° C. ; the latter appears to be an albumen, and coagulates at 55° C. to 65° C. The insoluble substances produced by clotting are known as myosin fibrin and myogen fibrin.

The above physiological data show that *rigor mortis* is certain to occur sooner or later, and throw some light upon the reasons for its delayed or early appearance, and also upon the length of its duration. There are, in regard to its medico-legal relationships, several independent points to be considered, and these we shall take in the following order :

1. The differences between living contraction of a muscle and *rigor mortis.*
2. The time of onset of *rigor mortis.*
3. The time of disappearance and the circumstances influencing it.
4. The order of its appearance and disappearance in different muscles.
5. Heat stiffening.
6. *Rigor mortis* in involuntary muscles.

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[1] *Bulletin Johns Hopkins Hosp.*, November, 1921.

(1) CONTRACTION *v.* RIGOR MORTIS

1. Contracted muscle is more or less transparent, or rather translucent.	1. Muscle in *rigor mortis* loses this translucency, and becomes opaque.
2. It is very elastic, *i.e.*, capable of restoration to its original form as soon as the distorting force has ceased to act.	2. It has lost this elasticity, and readily maintains a distorted position.
3. In reaction to litmus it is either neutral or slightly alkaline, and any reduction in this alkalinity is very speedily removed.	3. It is distinctly and permanently (until decomposition is advanced) acid in reaction, owing to the development of sarcolactic acid and probably other acid bodies.
4. If the contraction be overcome by mechanical force, the muscles, though they may remain for a time uncontracted, possess still their inherent power of contraction; they may then keep the limb fixed in a new position or allow a return to the old position.	4. If *rigor mortis* be overcome by mechanical force, absolute flaccidity, corresponding in degree with the amount of mechanical movement, at once ensues, and there is no power to resume the old position nor any new one, except so far as gravity may cause a new position. This flaccidity is permanent till decomposition destroys the muscle.

(2) TIME OF ONSET OF RIGOR MORTIS

Rigor mortis generally commences within three to six hours of death, while the body is cooling, but long before it has reached the temperature of the surroundings. To this general statement there are, however, numerous exceptions, some of which can be explained by the well-known principles of physiology mentioned above, while others hardly admit of such satisfactory explanation. Its ultimate onset is a matter concerning the muscles only, and is independent of the integrity of the nervous system, for a division of nerves leading to particular muscles or even the removal of the brain has not been found to prevent its occurrence; it also occurs in amputated limbs.

Thus it is easy to understand that it should come on slowly in healthy, muscular subjects who have died without convulsions, as, for instance, by decapitation, by sudden hæmorrhage, by judicial or even other forms of hanging. In such cases the muscles have no more than the average amount of waste products in them, and have their usual circulation at the moment of death, conditions favourable to the continuance of local life, of which it must be remembered that rigor marks the end.

It is also easy to offer, in some measure, an explanation of why it should set in rapidly in new-born infants. Their muscles are engaged in a very active process of growth, and consequently have no large reserve of energising materials available for continued local life.

Ante-natal Rigor Mortis. Two cases of this condition are reported[1]. The first case occurred in a quadripara, aged thirty-five, in labour near term with a history of twelve hours' hæmorrhage. Version was performed as soon as possible, and was rather difficult owing to the rigidity of the child. When extracted, the lower limbs were still slightly stiff, and the arms markedly flexed and rigid. The rigidity did not return. Fœtal movements had ceased for ten hours. No attempt had been made to hear the fœtal heart. The second case occurred in a primipara, aged thirty, in labour at term. The labour was slow, and the membranes ruptured early, and five hours later the fœtal heart could not be heard. The fœtus was extracted by forceps later on, and was in pronounced *rigor mortis.* The child was large, very muscular, and well nourished. When present there is no doubt that rigidity does interfere with delivery, in spite of statements to the contrary. Of the various conditions associated with ante-natal rigidity hæmorrhage seems the commonest. The whole subject of ante-partum *rigor mortis* is fully discussed by Dr. J. W. Ballantyne.[2]

It may be noted that *rigor mortis* is thus proved to be of no value as a sign of live-birth.

Again, it is quite in accord with our data that all circumstances which cause an exhaustion of muscles during life should induce an early occurrence of rigidity. Thus violent exercise or exertion just before death accelerates the onset of rigor, as is well seen in hunted animals, in overdriven cattle, in cases of poisoning by strychnine, and other convulsant poisons. The bodies of soldiers killed in the early part of a battle become rigid slowly, while the bodies of those who are killed after many hours of violent muscular exertion become rigid almost immediately.

Brown-Séquard poisoned three healthy dogs, as much alike as possible, with acetate of strychnine. One of them had a dose of two grains, another of half a grain, and third of one-fourth of a grain. The first dog died at once; the second after twelve minutes, during seven of which it had convulsions; and the third after twenty-one minutes, during which eleven of which it suffered from convulsions. The following are the tabulated results in reference to the duration of muscular irritability and of cadaveric rigidity, as well as to the occurrence of putrefaction :

	Durat. of musc. irrit.	Durat. of cad. rigid.	Putrefaction
1st dog	8 hours	19 or 20 days	Slow.
2nd dog	2½ ,,	5 days	Rapid.
3rd dog	½ hour	Less than a day	Very rapid.

In the body of a strongly built woman, who died of hydrophobia with violent convulsions, Brown-Séquard found that cadaveric rigidity had set in within the first hour after death, and that it had ceased before the end of the tenth hour.

(3) When does it Disappear ?

Although muscles in which none of the micro-organisms concerned in decomposition could be demonstrated have been found flaccid, there can be no reasonable doubt but that the disappearance of *rigor mortis* is rapidly followed by the onset of putrefaction.

It has been suggested that flaccidity following *rigor mortis* is caused by a solution of myosin in ammoniacal alkaline liquids produced by putrefaction. There can be no doubt of the fact that those circumstances at death which tend to leave a muscle full of products of its own disintegration, presumably unstable organic bodies, tend to shorten the duration of *rigor mortis* and to hasten the onset of decomposition. These are precisely the conditions which, we have seen, hasten the onset of rigor, and from these facts the well-known rule follows as a matter of course, *viz.*, the sooner rigidity sets in the more quickly it disappears and gives way to putrefactive processes. Of this the following is a good example :

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[1] *Amer. Jour. of Obstet.*, August, 1903.

[2] *Teratologia*, vol. 2, April, 1895, p. 96.

> A man died in one of the Parisian hospitals in 1849 in whose body cadaveric rigidity appeared three minutes after he had ceased to breathe, and while the heart was still beating twenty times in a minute, while the man was still alive, if life is considered to persist so long as the heart beats. These beats did not cease till three minutes and a half after cadaveric rigidity had shown itself everywhere. A quarter of an hour afterwards there was no trace of cadaveric rigidity, and in less than an hour after death signs of putrefaction had appeared in the limbs. This man died of exhaustion after prolonged typhoid fever.[1]

On the other hand, myosin is soluble in acids, and the view has been put forward by Hermann that the disappearance of rigidity is due to solution of myosin by excess of acid produced during the continuance of rigidity.

A third supposition is that in *dead* muscle ferments are developed which have the power of dissolving myosin by a process of auto-digestion.

Von Fürth considered that the disappearance of rigor is due to *coagulation* of the proteins, thus reducing their hydrophilic properties.[2]

Speaking in general terms, *rigor mortis* lasts for from sixteen to twenty-four hours in sound, muscular subjects ; it may last much longer, from twenty-four to thirty-six hours, and exceptionally it may continue for fourteen days or even longer.

> In a case in which Taylor was consulted, a stout muscular man died suddenly from an attack of apoplexy. His body was exhumed and examined three weeks after death in the month of January. It was in a good state of preservation and the limbs were so rigid that it required a great degree of force to bend them.

No doubt in this case cold favoured the continuance of rigidity. Symonds also saw a body in a state of rigidity eight days after death by hanging.

The Influence of Atmospheric Conditions. Atmospheric changes appear to modify considerably the duration of this state. Dry, cold air will cause it to persist for a long time ; and thus it is that during the winter season, especially in a frost, it is slow in disappearing, its mean duration being then from twenty-four to thirty-six hours. If the air is warm and saturated with humidity, it soon ceases. In the tropics, where the temperature ranges between 80° and 100° F., rigor usually begins to disappear in twenty to twenty-four hours. Temperature appears therefore to affect its duration and intensity.

> Sommer found that, other things being equal, bodies became rigid as quickly in an atmosphere of from 59° to 63° F. as in one from 77° to 81° F. ; but that the bodies of strong persons continued rigid for eight or ten days at a temperature of from 36° to 45° F., while it totally disappeared in from four to six days when they were exposed to a temperature of from 65° to 86° F.

Bodies sunk in cold water soon pass into this state, and retain the rigidity for a long time. Water is a better absorbent of heat than air, and tends to retard putrefaction.

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[1] Savory, " On Life and Death," p. 196.

[2] Wells, " Chemical Pathology," 4th Edition, 392-395.

At the trial of Birchall for the murder of Mr. Bernwell at Woodstock, Ontario, in September, 1890, the medical witnesses were at variance. Bernwell was shot in the head, and must have died instantaneously. The temperature of the atmosphere was 22° F., and the deceased body when found was rigid and frozen. Welford, for the prosecution, deposed that at the temperature of 22° F. rigor would supervene in from one to three hours; whilst Means, for the defence, swore that the above degree of cold would retard the onset of rigor, which would not set in till after the lapse of twelve hours.

These facts will be found to depend upon the causes of decomposition, and will be again referred to under "Decomposition."

The Influence of the Nature of the Death in Ordinary Diseases. It has been long observed that the bodies of those who are emaciated, or who die from debilitating diseases, such as pththisis, typhus or typhoid fever, and epidemic cholera, pass rapidly into a state of rigidity, which is commonly of short duration. Hence, owing to want of correct observation, it has been erroneously stated that cadaveric rigidity did not occur in such cases. In reference to deaths from epidemic cholera, Brown-Sequard observed that cadaveric rigidity appeared late and lasted long in those patients who died quickly, that is, before a profound alteration of nutrition had set in, and that those muscles which had been attacked with violent and frequent cramps became rigid very soon after death, and remained so only for a short time. Ollivier found that the bodies of cholera patients were frequently rigid in from six to eight hours after death, while the muscles which were the seat of this rigidity were still warm, and on making an incision into them the blood readily flowed out. It has been noticed that, whereas in the majority of bodies *rigor mortis* is well marked, it is frequently absent in the bodies of those who have died from generalised septicæmia; and especially has this been the case in separate limbs which have been the seat of purulent infiltration amongst the muscles. This is a most striking phenomenon, owing to the contrast between the rigid and the flaccid muscles.

In this case the duration is obviously in strict accord with the condition of the muscles in regard to the amount of products of disintegration still present at the time of death compared with the activity of healthy circulation through them (*vide supra*).

The Influence of Death by Lightning. It was thought at one time that rigidity did not occur after death from lightning, but facts are now sufficiently numerous to enable us to say that this idea is incorrect.

Death by lightning may be the result (1) of syncope by fright, or in consequence of a direct or reflex influence of lightning on the vagus nerve; (2) of bleeding into or around the brain, the lungs, or peri-cardium; and (3) of concussion or some other non-recognisable change produced by the electricity on the brain and nervous system. When death by lightning is due to any one of these causes, cadaveric rigidity may appear and run through its course rapidly, as in some other cases of sudden death. But (4) lightning may destroy life like a powerful electric shock, by producing such a violent convulsion of every muscle in the body that muscular irritability ceases almost at once. The rigidity in this case may be of such short duration as entirely to escape notice. Lightning may indeed reduce the duration of muscular irritability to the fraction of a second, and that of cadaveric rigidity in a corresponding degree, so that no trace of it may remain even a few minutes after death.

There is a difference in the electrical conductivity of living and dead muscle. Dead muscle is a much better conductor than living muscle; this increase in conducting power is due to the presence of certain products of decomposition which do not appear until after death.

The Influence of Death by Poison. We have already drawn attention to some of the effects of poisoning by strychnine, and laid down a general rule on convulsant poisons, bearing on the *onset* of rigor in such cases. We have here to note an apparent exception to the rule of "Soon come, soon gone," for the rigidity produced as a result of poisoning by strychnine is alleged sometimes to continue for a very long period. Thus, in *R. v. Palmer*, the body, when examined on the sixth day after death, was reported to be in a state of rigid spasm and some of the members were found in a similar state on the exhumation of the body two months afterwards. In this case the victim lived only twenty minutes after the symptoms first appeared. He suffered from a few convulsive fits, but not sufficient to exhaust the irritability of the muscular system.

This fact has an important bearing on cases of poisoning by strychnine and other spinal poisons. The state of the dead body will vary according to the rapidity of death, and the degree of exhaustion of muscular irritability at the time of death, as a result of the fits of convulsion produced by the poison.

Of other poisons it may be said in general that those which have an antiseptic action, such as arsenic, mercury perchloride, etc., are likely to cause a delay in putrefaction, and hence a prolonged state of stiffness in the muscles; others are likely to be quite indifferent in the matter unless causing great exhaustion; while some seem to have a tendency to induce rapid decomposition.

Rigidity is said to be slow in manifesting itself in death from hæmorrhage, irritant poisoning, apoplexy, wounds of the heart, decapitation, as also in all cases of asphyxia, especially in death from hanging, or from the action of carbonic acid.

In a case of suicide from a wound in the throat, observed by Handyside, the rigidity of the muscular system commenced while the body was yet warm, and was complete in *one hour and a half* after death. This early occurrence of rigidity cannot be referred to any influence produced on the muscular system by loss of blood. In a case of death from hæmorrhage, in which four pounds of blood were suddenly lost from the axillary artery, it was observed that eight hours after death the arms and legs were pliant; and it was not until twelve hours after death, when the body was becoming cold, that rigidity manifested itself. Death by hæmorrhage, therefore, does not accelerate this condition; it appears to have no more influence upon the period of its occurrence than it has upon the cooling of the body. So, with regard to irritant poisoning in an acute form, no difference was observed in reference to the rate of cooling or the commencement of rigidity in a well-marked case of death from arsenic in eleven hours.

(4) THE ORDER IN WHICH IT APPEARS IN DIFFERENT MUSCLES

Cadaveric rigidity first appears as a rule in the muscles of the face, neck and trunk; it then takes place in the muscles of the upper extremities, and lastly in the legs. In regard to its disappearance, the muscles of the lower extremities will often be found rigid, while those of the trunk and upper extremities are again in a state of relaxation. It appears later and lasts longer in the lower extremities than in other parts of the body. It begins almost always in the neck and lower jaw. Sommer found only one exception to this rule in examining two hundred dead bodies. From the neck it passes in two directions: upwards to the muscles of the face and downwards to the muscles of the upper extremities and trunk, then attacking those of the lower extremities. In individual limbs, it commonly proceeds from above downwards, and it generally passes off in the same order. It always sets in, increases, and decreases imperceptibly and gradually, in which respect it differs strikingly from the rigidity of muscles as a result of disease.

(5) Heat Stiffening

Myosin coagulates in mammals about 44° to 50° C., while myogen coagulates at 55° to 65° C. If therefore, the body is subjected to heat exceeding the above temperatures, these substances are coagulated, and a degree of rigidity is produced equal to or even more intense than is found in *rigor mortis*. This stiffening remains for a much longer time than *rigor mortis*, and as a rule the body is markedly contorted, practically every muscle of the limbs being affected. It is a point which might be of importance in bodies taken from a burnt building or found burnt under other circumstances.

(6) Rigor Mortis in Involuntary Muscles

The involuntary as well as the voluntary muscles are subject to cadaveric rigidity and, by reason of the more speedy loss of muscular irritability, it appears in them more rapidly. The ventricles of the heart commonly lose their irritability within an hour after death. The muscle becomes rigid, and remains in that state for ten or twelve hours, sometimes for twenty-four or thirty-six hours, then again becomes relaxed or flaccid (Carpenter). Duval saw the heart of a criminal a quarter of an hour after decapitation beating with great distinctness. The left auricle in particular exhibited strong and regular action, forty-four times in a minute, and continued to do so for an hour. At a certain period after death the heart becomes rigid and firmly contracted. If examined at this time, it may appear to be in a state of spasm and to have its walls thickened, while the cavity of the left ventricle may be described as being much smaller than in the normal state. Paget has pointed out that this natural condition of the heart after death had led to pathological mistakes, the walls being described as thickened and the cavities as being diminished in size, and the heart itself as being in a state of concentric hypertrophy from disease. On the other hand, the perfect relaxation of the heart which follows at a later period after death has been mistaken for and described as a morbid flabbiness and flaccidity. Spasms or paralysis cannot be inferred to have existed when we discover these conditions of the heart in the dead body.

The point is of importance with regard to deductions made as to the exact cause of death from the *post-mortem* appearances of the heart and blood-vessels of the brain. Thus it is too readily assumed that death was caused by asphyxia because the heart is found relaxed and full of blood, or because the meningeal vessels are filled with blood. It cannot be too strongly insisted upon that the amounts of blood *still within heart and vessels* may be ignored, in forming such conclusions, to any extent that circumstances may warrant, and *entirely ignored if there is no other evidence of how death was caused.* If blood is *extravasated out of the vessels* the arguments are quite altered (*vide* " Asphyxia ").

C. Instantaneous Cadaveric Rigidity. This is a phenomenon which lies quite outside any of the laws hitherto considered regulating ordinary *rigor mortis*, and yet is one of the most important in legal medicine, owing to the certainty of the conclusions which may be drawn from it when it occurs.

On p. 186 it is stated that immediately after death the muscles enter into a state of relaxation, though they are still irritable and capable of being stimulated into contraction. The point we have now to consider is the undoubted fact that **this period of flaccidity may be absent,** and that the body may be **instantaneously stiffened** in the position in which it was **at the moment of death.**

We will first illustrate this statement by a few cases the histories of which are known, and about which no suspicion can be entertained that the manner of death was not as it is related to have been.

Brinton recorded his experience on this subject during the American civil war in 1862. In many who had died instantaneously from brain and heart wounds, the body was rigid throughout, and the position was that of the last moment of life. He has called this *instantaneous rigor*. After the battle of Antietam, he counted within a small space forty dead bodies, mostly with chest wounds. There were some with their arms raised rigidly in the air, and others with their legs drawn up and fixed. In not a few the body was curved forwards and fixed. These attitudes were not those of the relaxation of death, but were rather of a seemingly active character, the muscles remaining rigid and inflexible as the result of spasmodic muscular action in the last moment of life.

A young man while skating fell through the ice of a pond about seven yards deep. He was not totally immersed, for he kept his head and shoulders out of the water above the ice, with his arms resting upon it ; and as the ice gave way under his weight, he sprang to a fresh portion. Before assistance could be rendered he sank. The body was recovered the next day ; it was found at the bottom of the pond, beneath the hole in the ice. The arms of the deceased were stiff, and still retained the position in which he had rested upon the ice ; his legs were quite extended, and the muscles on the fore part of the thigh were very much contracted. as if they had been powerfully exerted in keeping him erect while he was hanging on the ice. There was no appearance of his having attempted to breathe after he had gone below the water. His countenance was quite natural, and there was no water or froth in his mouth ; the external appearances resembled those which are seen in a body immersed after death from some other cause. There was no internal inspection.

An aged man, while at the theatre with his family, rested his forehead upon his hands, which were crossed in front of him, while with his elbows he leaned on the front of the box. It was thought that he had gone to sleep in this attitude. and he was not disturbed ; but after the performance was over, and the persons were about to leave the theatre, it was found that he was dead.

A lady who had retired to her bedroom in perfect health was found dead the following morning. She was kneeling at a chair in the attitude of prayer, and her body had become rigid in this position.

The bodies of persons who have been drowned at the same time by a common accident are frequently found clasped in each other's arms. A contracted state of the muscles at the time of death has passed into perfect rigidity, and thus the attitude or the last act of life of the individual has been preserved.

In many cases of undoubted suicide the weapon, whether pistol, gun, or knife has been found *firmly grasped* in the hand with which the fatal wound was inflicted.

There is no sufficiently good explanation of instantaneous stiffening, and the fact that it cannot readily be reproduced experimentally[1] raises a difficulty in its proper investigation. Its occurrence is by no means common, but though even in a busy medico-legal practice the condition is found only in a few cases of sudden and violent death, the hands should always be examined for the presence of hairs, fibres or other substance strongly grasped in them.

Turning to the practical aspects of the matter, experience has shown :

1. That instantaneous stiffening is *cœteris paribus* more likely to exhibit itself when great muscular exertion has been made previous to death.
2. That it is also more likely to appear in strong and muscular subjects, whether they are or are not exerting themselves powerfully at the time of death.
3. That *sudden* death is a predisposing factor.
4. That death due to violent disturbance of the nervous system (apoplexy, gunshot wound of the head, etc.) is also a powerful element in causation. This mode of death has been experimentally shown to be capable of producing instantaneous rigidity, or cadaveric spasm.
5. That drowning and other forms of asphyxial death, and also cold, have similar predisposing tendencies towards cadaveric spasm.
6. That it does not invariably occur under circumstances that would seem to be most favourable, and occasionally occurs in tranquil deaths when it might not be expected.
7. That the condition of affairs produced by it is easily distinguishable from that produced by simple *rigor mortis* in that an object grasped by the fingers is firmly gripped just as it would be during life, only that more force is required to extract it from the grip than would be necessary during life, whereas if held by *rigor mortis* alone the object can be easily lifted off the fingers, so to speak, there being no acute flexion and grip.
8. That it is the strongest and most conclusive proof that the object so gripped was thus gripped at the moment of death.
9. Lastly, it is for practical purposes impossible for the condition to be imitated by a murderer. The reason for this is that if a murderer has a knowledge of the above facts sufficiently acute to lead him to try to imitate the condition he must find one of two conditions : (*a*) the muscles flaccid, in which case he must place the fingers round the weapon and fix them there by a bandage, or by holding them until *rigor mortis* sets in, and in this case there will be evidence of the pressure applied ; or (*b*) the muscles stiff, in which case, he must loosen them and again try to refix them by pressure, of which secondary fixing there will again be evidence, not to mention that the secondary fixation by the muscles will not take place.

The following cases collected by Taylor are illustrative of the above conclusions and of their importance. The observation of the condition is constantly being made, but it is now accepted so much as a matter of course that it is scarcely considered to be worthy of report. Numerous cases were reported in the course of the European war, 1914-1918, and further instances during the recent war 1939-1945.

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[1] *Cerquiglini S. Bol. Soc. Ital., Biol Sper* 14 : 672, 1939 says that a lethal dose of α dinitrophenol causes instantaneous rigor in rabbits.

In the case of Lord William Russell, who was murdered by Courvoisier in 1840, it was observed that one hand of the deceased firmly grasped the sheet of the bed, as if in a struggle against an assassin. The position of the hand of the deceased furnished among other circumstances, some evidence against the presumption of suicide.

In *R. v. Ellison* some of the prisoner's hair was found grasped in the victim's hand.

The body of the deceased was found lying dead in the house, with such injuries about the head as to render it certain that she must have been murdered. In her right hand was found a considerable quantity of brown hair, and in the other hand some grey hair, grasped evidently in the struggle for life. On the morning following the murder the prisoner went to a hairdresser's in the town, and desired to have his hair and whiskers cut. This man observed that the hair and whiskers had been recently cut, and evidently, by some one unaccustomed to haircutting. There was a difference between the hair of the whiskers and that of the head, the former having turned grey. The hairdresser was of opinion that the hair found in the hands of the deceased was of the same colour and kind as the hair of the prisoner. This, with other corroborating circumstances, led to his conviction.

At the trial of a man for murder there was evidence that the deceased, his wife, was found dead with her throat severely cut, and there was a razor, not grasped, but lying loosely in her hand. There was no blood upon the hand which held the razor, and this, together with the fact of the razor being loose, rendered it probable that the weapon has been placed there by some person after the throat of the deceased had been cut.

In *R. v. Gardner* a woman had died from several wounds in the throat which could not have been self-inflicted, and a common table-knife was found loosely in her right hand, with the back of the blade towards the palm of the hand, and the weapon in the direction of the length of the body. According to the evidence of the medical witnesses, the principal wound in the throat was of such a nature that it could not have been inflicted with the right hand.

This proved that there had been interference with the body after death, and Taylor remarked : " On these occasions it may be suggested that a weapon, although grasped by an alleged suicide to inflict the death-wound, may either drop from the hand or be found loosely in it, as a result of the relaxation of the muscles in death. This must be admitted ; hence the mere fact of a weapon being found loose should not be taken as evidence of murder, unless other circumstances—such as the nature of the wound, the freedom of the hand from blood, the position of the body, etc.—concur to prove that the act was not one of suicide"; and other circumstances may show that the weapon after all has been placed in the wrong hand, or that the blood-marks on it and on the hand have no correspondence.

The difficulty of thus endeavouring to imitate an act of suicide, when the facts are properly observed and compared, will be apparent from the following case.

The deceased in this case, a female, was found dead in bed with her throat cut, The medical evidence showed that the wound was six inches from right to left. extending across the throat to a point under the left ear ; the upper portion of the windpipe was severed, and the jugular vein as well as the muscular branches of the carotid artery were divided. The medical witnesses considered that the wound in the throat had not been inflicted by herself. It was such a wound as a *left*-handed person would have inflicted, and the hand inflicting it, as well as the weapon, could not have escaped being marked with blood. It appears that when the body was found there was a razor in the *right* hand, not tightly held. The arms were folded across the chest, the right hand resting on the left, the back of the razor being towards the body of the deceased. There was *no blood on the hands*, arms, or chest, and only one small spot on the razor. There was blood on the underside of a pillow, and a corresponding stain on the bolster, showing that this must have been turned over, and the head placed on the clean side after the infliction of the wound.

All the circumstances concurred in showing that an attempt had been made to simulate an act of suicide, while the facts were only consistent with homicide. The prisoner was connected with the act by moral as well as circumstantial evidence, and he was convicted and executed.

In drowning, it is by no means unusual to find, when dead bodies are taken from water soon after the accident, that pieces of rope, an oar, grass similar to that growing on the banks, or weeds like those growing at the bottom of a canal or river, are firmly grasped in the hands. This latter is the strongest proof we have that the individual has gone into the water living (*vide* " Drowning "). Part of a dress may be thus found grasped in the hand, and serve to identify a person accused of murder.

10. Putrefaction

This is the final stage or sign of death. Strictly speaking, putrefaction means the destruction of nitrogen-containing substances, brought about by the influence of microbes, with the production of foul-smelling gaseous products. In bodies openly exposed to the air, water, and soil, etc., various animals—ants, beetles, flies, rats, fish, etc.—assist in the destruction of the body, but this is another matter, and under ordinary circumstances micro-organisms alone are responsible for decomposition.

The breaking down of the protein compounds (known as putrefaction) takes place in stages, and at one and the same moment a large number of chemical substances may be present in the putrefying mass. Of these many have been chemically identified, such as formic, acetic, butyric, valerianic, palmitic, lactic, succinic and oxalic acids ; amines and amino-acids, such as leucin and tyrosin ; and various aromatic substances like indol and skatol. Mercaptans are formed in anaerobic putrefaction. Variations in the putrefactive process depend on a series of factors many of which are not completely understood.

These putrefactive processes are mainly the result of the activity of micro-organisms. As is well known, the gastro-intestinal tract contains large numbers of different kinds of organisms (one-third of the total weight of the solids of fæces may consist of bacteria) during life, and it is these organisms which are mainly instrumental in promoting putrefaction. Bacillus coli communis and B. proteus have been known to invade the blood stream even before death, but after death occurs, organisms of all kinds make their way into the vessels with great rapidity, and by means of the blood-vessels pass to the whole of the tissues of the body. Ottolenghi,[1] in his researches into the bacteriology of putrefaction, found that within forty-eight hours of death, when the body was just commencing to putrefy, the blood in the heart contained B. mesentericus, B. subtilis and Micrococcus albus.

It is probable that in the early stages of putrefaction aerobic bacteria play the principal part, and that in the later stages facultative aerobes and anaerobes carry on the process. B. aerogenes capsulatus produces gas in large quantities and in certain cases causes the liver and other organs to be riddled with minute gas bubbles. The cavities of the body may be rapidly distended with gas and as hydrogen and methane are sometimes evolved, ignition may occur.

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[1] *Vierteljahrssch für Gericht. Med.*, 1892.

Microbes depend upon their environment for activity. Thus some require oxygen (aerobic): some can do without oxygen (anaerobic); all organisms require a certain degree of moisture, but the degree of moisture at which they can do their best work varies with the genus; some can work best at or about the temperature of the living body: others are equally or more active at what may be called the average temperature of the air. Extremes of temperature either kill outright, or inhibit the activity of all microbes.

Microbes exist in countless millions in the intestines, in the respiratory passages, on the skin and in all the orifices and cavities connected with the exterior, and may sometimes be found in the tissues and organs of the body.[1] After death they may be found distributed throughout all organs and tissues, especially the blood.

They also exist in incalculable numbers in the soil of the earth's surface, especially in the upper foot or eighteen inches. They are found in the air in varying numbers and varieties, and in water.

It is probable that they form, in the tissues they are feeding on, bodies of the nature of ferments which can for a limited time continue to decompose the tissues even when their producers die or lose their vitality. Many such ferments have been isolated.

From these considerations we are able in some degree to understand some of the phenomena of decomposition under ordinary circumstances; but the action of the environment, the inherent potentialities of the microbes, and the state of their vitality at any moment involve such an enormous number of varying and variable factors that it becomes quite impossible to explain on a rational basis of ascertained fact the extraordinary variations in the circumstances of putrefaction that have been observed.

Description of Putrefaction as ordinarily observed. We may now describe the process as it usually occurs and then consider many interesting and important points in connection therewith.

To facilitate reference, a table is here inserted of the order of discussion:

1. Colour changes, external and internal.
2. The gases of decomposition.
3. The effects of these gases.
4. Circumstances influencing the onset and progress of decomposition.
5. Observed facts in the order of decomposition of the internal organs.
6. Differences between bodies exposed to the air and those that have lain in water.

1. COLOUR CHANGES IN PUTREFACTION

Externally these consist in the appearance of a yellowish-green, or bright green, or coppery red discoloration of the skin. The point where this commences and the direction in which it spreads differ somewhat according to whether the body has been exposed to the air or has remained in water; the rate at which it spreads and the rate of decomposition in general vary materially according to circumstances which will be considered later. Soon after the commencement of putrefaction the veins of the skin, particularly on the limbs and neck, become marked as dark purplish red or blue lines due to decomposition of the blood in them and a soaking of their coats by the altered blood pigment (the blood becomes alkaline with ammoniacal products). They then form very prominent objects to the eye on a background of lighter red, purple, green, or black skin.

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[1] Reith (*Jour. Amer. Med. Ass.*, January 30th, 1926) states that he found both aerobic and anaerobic bacteria in the muscles of healthy animals both before and after slaughter.

Internally much the same change of colour is observable in the viscera —liver, spleen, kidney—though shades of dark red, varying to black, are commoner tints than green. The bile also soaks through from the gall bladder and tinges the tissues in contact with, or near, it a yellow, or greenish colour, which resembles in some respects that of decomposition. With this colour change the viscera become softer and greasy to the touch ; they eventually break down into a uniform stinking mass, so that the individual organs can no longer be separately removed.

It is important to remember that these colour changes are *early* signs of decomposition, and that the organs, though discoloured, will show pathological changes ; it is therefore inadvisable to decline to proceed with an examination on the supposition that the organs may be too decomposed to reveal other facts of importance.

2. Gases of Putrefaction

The following is a table of the gases formed, according to Tidy, but the offensive nature of the gases evolved indicates that others are probably present, such as the mercaptans :

Early.	Later.	Latest.
SH_2	CH_4	NH_3
CH_4	CO_2	N
H		
NH_3		CO_2
PH_3		
CO_2		

Lewis examined and reported on the external condition and appearance of 22,000 coffins accumulated in the vaults of London churches. He examined the state of the contents of about one hundred of these. The examinations were made on the bodies of persons of all ages, and on coffins which had been deposited from a short period to upwards of a century. He did not find therein sulphuretted, phosphoretted, or carburetted hydrogen, or any compound of cyanogen. The gases which he uniformly detected in the coffins and the vaults were nitrogen, carbonic acid, atmospheric air, holding putrescent animal matter in suspension. Ammonia was occasionally found in large quantities ; this when present overcame all other odours, when absent the animal matter had a smell resembling that of putrid moist cheese. He opened one leaden coffin in which the corpse had been enclosed for nearly a century ; the ammoniacal gas which escaped from it formed dense white fumes when brought into contact with hydrochloric acid gas. It was so powerful that he could not remain near it for more than a few seconds at a time[1]. The same results were noticed in reference to a body which was exhumed after six months' interment. When the coffin lid was removed by the side of the grave a large quantity of fœtid ammonia escaped. On throwing into the coffin some chlorinated lime dense white clouds of chloride of ammonium were evolved from the interior of the coffin, to the great alarm of some of the bystanders, who were not aware of the chemical changes produced. It would appear that the air enclosed in coffins is in general completely deoxidised. When tested it was not inflammable, but was found in every instance to extinguish flame. In leaden coffins putrefaction is so much retarded that the remains of bodies were found in them after the lapse of a century. The metal is slowly corroded and changed into white lead.

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[1] *Amer. Jour. Med. Sci.*, January, 1852, p. 275.

The chemical composition of these gases is of little medico-legal interest, but the points that are of importance are that they do form beneath the skin, in hollow viscera, and, eventually, in solid viscera under considerable pressure, and produce effects that are of the highest importance.

3. Effects of Pressure of the Gases of Putrefaction

1. **Blood Displacements.** We have already drawn attention to the fact that after death the arteries, by virtue of their elasticity and power to contract, empty themselves into the veins, and may thus cause a *post-mortem* hæmorhage from a wounded surface (vein or capillaries). We have here to mention the more special effects of decomposition which cause—

(*a*) *Post-mortem bleeding* at a later date than that mentioned above. This form does not offer so much difficulty in deciding whether the wound was *ante* or *post-mortem*, because the resulting outpouring of blood will show no trace of coagulation; it will have simply soaked into the surroundings like so much coloured fluid.

(*b*) *Shifting of an Area of Hypostasis.* Owing to the pressure of the gas developed in the blood of a hypostatic area, this may be displaced in any direction. Taylor saw a body in which the cheeks acquired a florid red colour between the third and fourth days after death, when rigidity had ceased. It is hardly necessary to observe that this appearance, coupled, as it is stated to have been in some cases, with a slight degree of warmth, could not give rise to any mistake concerning the fact of death, since the rest of the body would be cold, and in death the face becomes cold before the skin of the chest and abdomen.

The importance of the fact lies in this, that when once putrefaction has commenced in a dead body the inferences as to the position in which the corpse has lain since death will be materially weakened so far as they rely upon the position of hypostases for their support.

(*c*) *Emptying of the Heart.* When putrefaction has commenced, and there is no open wound from which blood can escape, the cavities of the heart may suffer compression from the gases generating within the chest and abdomen, and a portion of the blood may be forced out of them, but it is not probable that the cavities could be completely emptied by this pressure. If the heart is found empty, and at the same time contracted, its emptiness cannot be assigned to the effects of putrefaction; it is the natural condition of the organ shortly after death still persisting in spite of decomposition.

2. **The Gases blow up the Features.** We have already mentioned how death alters the features so as to make recognition less easy. With the onset of putrefaction the features are so blown up, swollen, and altered in colour, that identification becomes absolutely impossible. Indeed, the likeness to a human being is sometimes difficult to realise, when lips, nose, eyelids, and cheeks are distended into a simple green sphere. The eyes may be forced forward almost from the sockets and the tongue become blackened and forced forward against the teeth or even protruded between them, and thus a picture of violent death from strangulation may be closely imitated. It is impossible to lay down any rules of general application to differentiate the two. The facts only emphasise the caution which must be used in deciding that death was due to strangulation when a body is found very advanced in decomposition.

3. **They force Frothy Mucus and even the Contents of the Stomach into and from the Mouth.** The importance of this fact lies in the erroneous inferences which may be drawn as to the cause of death when such froth or material is found running from the mouth. Thus froth about the mouth has been assumed to point to death from drowning or from poisoning, but even in bodies which are quite fresh such an inference is untrustworthy, for froth may be seen issuing from the mouth in persons dead from various diseases. In putrefaction froth and stomach contents are commonly seen issuing from the mouth and nose. The finding of such substances below the larynx, in the trachea or bronchi, however, strongly suggests asphyxia.

4. **They may force a Foetus from the Uterus.** A case of this kind was reported in the *B.M.J.*, 1895, vol 1, p. 633 :

Mr. Evan Jones, surgeon to the Aberdare Cottage Hospital, reported the case of M. M., who was eight months gone in pregnancy.

> " When seen she appeared *in articulo ;* she had general dropsy, and was violently convulsed. The os was unusually rigid. I managed to dilate so as to admit an index finger. During manipulation her condition got so critical that we thought it advisable to delay dilatation. Dr. Thomas saw her four or five hours before death, and the os was then in the same condition. He saw her again five hours after death, and the child was *in utero*. He then assisted the midwife to lift her on to the bed. Two days afterwards, the undertaker, on putting the body in the coffin, found the child and placenta between her legs with fluid running freely from the vagina."

Another case was reported by Dr. Albert Green, of Chesterfield, as follows :

> " On October 27th, 1894, I performed a *post-mortem* on a young unmarried woman fifty-three hours after death. On looking at the body I found, between the thighs, a full-time child, with the uterus inverted and protruding from the vagina. The placenta was attached to the uterus, and the umbilical cord uncut. The women who laid her out immediately after death found no signs of the birth of a child, and no appearance about the perineum or vulva of such being imminent ; they saw nothing unusual or unnatural. They washed the body, and tied the feet together in the usual way. She had had pains, and probably labour had commenced before death. At the time of examination the abdomen was enormously distended with gases ; the body was very fat ; the face was black and swollen, the front of the chest and abdomen green, so that putrefaction had evidently well

set in; the perineum was considerably ruptured. There were no other marks of injury, either in the uterus or the vagina.

"The chief points of interest were :—

"(1) The birth of a full-time child some hours after death.

"(2) Inversion of the uterus with attached placenta.

"(3) The well-marked laceration of the perineum.

"Previous to hearing the evidence of the women who laid out the body I took it for granted that the child had been born during the life of the mother, for I examined the laceration of the perineum carefully, and quite believed from its appearance that it had occurred during life; the torn surfaces looked reddish and vascular. It is true no blood was found on the clothes of the deceased or on the bed. I made a cut close by in order to note any differences, and found the surfaces of this latter cut to look quite white and bloodless in comparison. The edges of the original laceration were in a more advanced state of decomposition than the surrounding tissues. Putrefaction was very advanced, the liver was almost diffluent, and the mucous membrane of the stomach was raised by gas bubbles."

The evidence leaves the question of whether the uterus, by its contraction alone, expelled the fœtus, or whether it was the gas that expelled the fœtus and inverted the uterus, but it establishes beyond doubt *post-mortem* extrusion of a fœtus, a point which might be of importance.

It is obvious that in certain cases this condition might be used to cover and conceal a case of criminal abortion. The subject was brought before the Medico-legal Society of Paris by Penard.

He was required to report on an alleged case of delivery thirty-six hours after the death of the woman in which the question of expulsion by gaseous putrefaction could not arise. A young woman died under suspicious circumstances after eight days' illness. It was only just before her death that the medical man in attendance discovered that she was pregnant, and had probably reached the fifth month. He made no examination after death, and when the body was laid out there was no unusual appearance. When raised to be placed in a coffin, thirty-six hours after death, a fœtus fell from between the legs of the corpse. On examining the body, the uterus was found with the placenta attached, inverted, and extruded from the outlet.

Penard, after fully considering the case as submitted to him, came to the conclusion that after the death of the woman the uterus would not retain the power of expelling the fœtus and inverting itself by spontaneous muscular contraction. No doubt there are great difficulties in admitting that a spontaneous action of the uterus after the death of the woman should be so powerful as not merely to expel the fœtus and placenta, but actually to invert or cause prolapsus of the organ; still the occurrence of such cases rests upon good authority. In these rare instances it is probable that the woman had reached the full term, and parturition might have commenced before death. In the case related by Pénard, the woman had only reached the fifth month, and at this stage of pregnancy, it is improbable that the *post-mortem* contractions of the uterus, without any assignable cause, would have operated to expel the child and invert the organ. It is more reasonable to suppose that in this case there had been criminal interference.

5. **They will cause Floating of a Body in Water.** The specific gravity of the whole body is only a little above that of water. Consequently, apart from other mechanical considerations, a dead body will sink until sufficient gas develops to make its specific gravity less than that of water. It then rises, and if the gas escapes it may sink, until it develops sufficient gas to cause it to refloat (*vide* under "Drowning").

4. CIRCUMSTANCES INFLUENCING THE ONSET AND PROGRESS OF PUTREFACTION

We have already briefly discussed the conditions of microbic life as observed in the laboratory; we have now to consider the ordinary influences as they exist on the earth and harmonise their effects with experimental results. As a matter of ordinary observation, it is found that the time after death at which putrefaction commences may vary from a few hours to many days, weeks, years or centuries, and experience has taught that the principal factors influencing putrefaction are—

1. The temperature of the air to which the body is exposed;
2. The presence of moisture;
3. Influence of access of air;
4. Influence of light;
5. Influence of the state of the body;
6. Influence of the nature of death;
7. Influence of chemical substances;
8. Influence of burial in earth;

and in this order they will be dealt with.

1. **Effects of Temperature of the Air.** The process is found to go on most rapidly in a temperature varying from 70° to 100° F. It will commence, other circumstances concurring, at any temperature above 50° F.; but at 32° F. it appears to be wholly arrested. The dead body may thus be preserved a considerable time in snow, ice, or in frozen soil; but if after removal it is exposed to a temperature between 70° and 100° F., the ordinary putrefactive changes are stated to take place with more than their usual rapidity. Erman states that the body of Prince Menchikof, one of the favourites of Peter I., was exhumed at Beresov, in 1821, after a burial of ninety-two years in the frozen soil of Siberia. Although so long a time had elapsed the body had undergone but little change. The heart and some other parts, with a portion of the grave-clothes, were removed and sent to the descendants of the deceased.[1] A still more remarkable instance of the preservative power of cold is exhibited in the discovery in a mass of ice at the mouth of the river Lena, in Siberia, in 1805, of the body of an ancient elephant the race of which was extinct before the historical period.[2]

At high temperatures—*i.e.*, about 120° F.—bacterial growth usually ceases and putrefaction is arrested although certain thermophylic bacteria thrive at that temperature. The effect of temperature is strikingly seen in the influence of season. A dead body exposed to air during summer, when the thermometer is above 60° or 70° F., may show more putrefactive change in twenty-four hours than a similar body exposed for a week or ten days in winter. This is a fact which demands consideration when an opinion is required, respecting the date of death of a body concerning which nothing is known. This influence of temperature is in accord with what we know of bacterial growth.

2. **Influence of Moisture.** A certain degree of moisture is necessary for the processes of putrefaction. The animal solids, however, commonly contain sufficient water for the establishment of the process. In a human body weighing 150 lbs. there are about 100 lbs. of water. The soft

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[1] "Travels in Siberia," vol. 1, p. 462

[2] *Quart. Jour. of Sci.*, vol. 8, p. 95.

organs differ much from each other in regard to the quality of liquid contained in them, and therefore in the degree in which they are prone to putrefaction. Thus the brain and the eye are in this respect contrasted with the teeth, bones, hair and nails. The fluids of the eye are rapidly decomposed, while the teeth and hair may remain for centuries unchanged.

Quekett examined a portion of dried human skin with hair upon it which had been exposed for many centuries on a door of Worcester Cathedral, and also other portions taken from the church doors of Hadstock and Copford, in Essex. He found upon them some hairs which were proved by the microscope to be human, thus confirming the old tradition that the skins of persons who had committed sacrilege were nailed to the doors of the churches which they had robbed.

If an organic substance is dried, putrefaction is arrested and dehydration of food stuffs is now in everyday use as a means of preservation. An excess of water, however, tends to retard and modify the process of putrefaction; thus, by allowing a current of water to fall on animal matter, it may be preserved for a long time. Water in excess seems to retard putrefaction by cutting off the access of air. The differences in decomposition in a body exposed to water and to air will be further referred to.

3. **Influence of Access of Air.** There are three separate points to be remembered here: (*a*) that the air which gains access to a corpse is not under ordinary circumstances aseptic, but may contain variable numbers of microbes; (*b*) the physical qualities of the air as regards motion and moisture; (*c*) the chemical constitution of the air which surrounds a body.

(*a*) *Septicity of Air.* Under this head we only require to note that free access of air at ordinary altitudes and in towns means that the supply of microbes to carry on the work of decomposition is inexhaustible, and as soon as one group has died out, finished its work, or failed to accomplish anything, other groups, possibly of different genera, can arrive to produce an effect. Bodies completely clothed putrify less quickly than naked bodies. It has been found that the higher the altitude of mountains the fewer the microbes in the air, which, with the lowered temperature, accounts for bodies remaining fresh on the tops of mountains for long periods. There are, however, in the body at death a sufficient number and variety of microbes for complete putrefaction, provided that temperature and moisture are favourable.

(*b*) *Physical Qualities of Air.* Air, apart from its temperature, influences decomposition according to whether it is dry or moist, at rest or in motion. Dry air retards decomposition by desiccating the tissues exposed to it, and if the dry air be in motion the effect is still more marked. It is in this way that natural mummification takes place. On the other hand, moist air provides a condition which is favourable to the microbes of decomposition, and the effect is enhanced if the moist air be warm and still. These effects are remarkably well illustrated in the case of Byrne (*infra*)

(*c*) *Chemical Constitution.* It seems to be well established that the majority of microbes require oxygen, without which they die, and seem to be incapable of splitting up even simple chemical combinations. For this reason carbonic acid and nitric oxide—especially the latter, since it at once combines with free oxygen—act as antiseptics. In a series of experiments on the properties of the gases in retarding putrefaction Taylor found that in one a large piece of fresh muscle was preserved effectually in a bell-glass of nitric oxide over water for eighteen weeks; in a second experiment, for nineteen weeks; in a third, for a period of thirty-two weeks, or 224 days; and in a fourth, for a period of seventeen months. The last experiment was commenced in October, and after eighteen months the muscle suspended in the gas retained its red colour, and had undergone no change indicative of putrefaction. These experiments were carried on under all variations of temperature in a room not below 40° in the winter season, but which sometimes reached 80° F. in summer. As the vessel containing the gas was placed over water, the gas was, of course, always saturated with aqueous vapour. Two of the conditions for putrefaction was therefore present. Oxygen only was removed. In some parallel experiments in air and oxygen putrefaction had gone to a full extent in eight or ten days. These facts show that oxygen, in a free state, is eminently necessary for the destruction of the soft parts of the body by putrefaction so far as this is done by aerobic microbes.

It may be safely stated that none of the ordinary gases of putrefaction act as antiseptics under ordinary circumstances.

Other organisms known as anaerobes can live only in the absence of free oxygen.

Little is known as to the atmospheres in which anaerobic microbes can act, but many gaseous chemical products, such as chlorine, SO_2, etc., are known to be fatal to microbic life, possibly by direct action on the microbes themselves, and hence have a reputation as antiseptics. That anaerobic microbes can, however, carry decomposition on to its extreme end is proved by the fact that they are used in one process of sewage disposal, which has been found successful so far as complete destruction of the sewage is concerned.

It must be admitted that when bodies are hermetically sealed in lead coffins, such anerobic microbes either do not gain access to the corpse, or soon cease their action, for such corpses are often found very little decomposed even after long periods.

4. **The Influence of Light.** This has not hitherto been found to have any practical influence on the commencement or progress of decomposition, but it is now established that light has a germicidal action, especially the rays of short wavelengths in the violet and ultra-violet parts of the spectrum.

5. **Influence of the State of the Body.** Fat and flabby bodies are observed to undergo putrefaction more readily than those which are thin and emaciated, probably because they retain heat better and the tissues are more moist. Connected with the state of the body, we may also mention the influence which wounds or bruises have over this process. Those parts which at the time of death are affected by wounds or bruising rapidly pass into a state of putrefaction, due to the more ready entry of organism into the lacerated part. Thus, in examining bodies which have been subjected to violence during life, bruises may appear greatly aggravated in extent, unless the examiner is aware that such parts become more speedily decomposed, and that blood will soak into dead tissues (*vide* below, " Cause of Death ").

Children are said to decompose more readily than adults, but the bodies of newly born infants who have not been fed resist putrefaction for long periods. The bodies of chronic alcoholics undoubtedly have a tendency to rapid putrefaction, though alcohol, *in vitro*, has some antiseptic power.

6. **Influence of the Cause of Death.** *Acute Disease.* The bodies of persons who have died from acute diseases have been observed to putrefy more readily than those of persons who have died from wasting and chronic disease. It would appear as if some diseases have either directly or indirectly a retarding or quickening influence over the process. It has been observed that the bodies of plethoric persons who have died suddenly while in good health have undergone rapid decomposition. In persons who have died from asphyxia, as by drowning, suffocation, or strangulation, the bodies are, *cœteris paribus*, observed to putrefy with great rapidity ; and, as a general rule, all those parts of the body which at the time of death are irritated, congested, or inflamed, are rapidly attacked by the putrefactive process.

Septic Diseases. These constitute a class of acute diseases, but they show in a very special degree the tendency to rapid decomposition. This is due to the fact that the pathogenic microbes which cause death are capable of carrying on decomposition after death ; and to the fact that the changes which the microbes and their toxins produce in living tissues constitute some of the earlier changes in the decomposition of such tissues. Many of the products of bacterial action are of the nature of ferments, and hence, even if the pathogenic organisms themselves die, these ferments may assist in putrefaction. The gaseous products of Bacillus aerogenes capsulatus or Bacillus Welchii may be specially mentioned in this connection as likely to assist by mechanically disintegrating the tissues and rendering access of air and microbes very easy.

Death from Poison. Conflicting statements have been made regarding the process of putrefaction in the bodies of those who have died from certain poisons. Thus it has been stated that in death from prussic acid, morphine, and other vegetable poisons, putrefaction generally commences early, and progresses with rapidity, while strychnine has been supposed to exercise a retarding power. But observation shows that putrefaction may be accelerated or retarded under the influence of the same poison, according to the modes in which it operates on the muscular system at the time of death.

Thus when strychnine destroys life rapidly, without exhausting the muscular irritability by frequent convulsive fits, putrefaction takes place slowly ; but if muscular irritability is destroyed before death, it speedily supervenes, and runs through its stages rapidly. In a death from nicotine, in which all muscular irritability appeared to be destroyed, putrefaction commenced early, and in a few hours had made great progress. The body was bloated, and the skin tense and much discoloured.

Some poisons, by chemically combining with animal matter, appear to confer on it the power of resisting putrefaction, at least to a very great degree. This is a well-known property of arsenic, and this poison is largely employed as a preservative. When a solution of it is injected into the arteries of a dead body, it tends to preserve it for a long time from putrefaction. In examining the bodies of persons poisoned by arsenic, after an interment of six, twelve, or twenty-four months, the stomach and bowels have been found to be remarkably preserved, and the liver, spleen and heart also preserved, but in a less perfect manner. The preservative effects are occasionally such that pathological changes in the mucous membrane may be observed after the bodies have been nearly two years in the grave. At the same time, it must be admitted that this preservative property is not manifested in all cases; hence we must not fall into the error of affirming that the person has not died from the effects of arsenic because the viscera are much putrefied. The greater part of the poison may have been expelled before death, or only a small dose may have been given to the deceased. These facts respecting the action of arsenic are now so well known to lawyers and medical men that they are seldom disputed.

Chloride of zinc, a powerful irritant poison, is another well-known preservative. It retards putrefaction apparently by combining with the tissues. In the case of Ann Palmer, whose body was exhumed after twelve months' burial, all the organs were found preserved; they contained antimony, which had penetrated even to the ovaries and the substance of the uterus. In the case of Harriet Lane (1875), her murderer, Wainwright, attempted to destroy the body by the use of chlorinated lime; but this substance acted as an antiseptic, and therefore as a preservative.

7. **Influence of Chemical Substances.** It has been alleged that there are certain chemical substances which have the property of accelerating the process of putrefaction; and among these *lime* has been particularly mentioned. The mineral acids and alkalies, in a concentrated state, act powerfully upon structures of the body; but they destroy it by corroding it, and not by producing any changes analgous to putrefaction. Persons who have been guilty of murder have endeavoured, but ineffectually, to destroy the dead human body rapidly, sometimes by attempting to burn it, and at other times by the use of nitric acid, lime, or chlorinated lime. The attempt has generally failed. Dr. Webster endeavoured to dispose of the dead body of Dr. Parkman by employing various chemical reagents, but without effect. In *R. v. Manning and wife*, it was given in evidence that the body of the victim was buried in a hole beneath the stone floor of a kitchen. The two prisoners, in order to destroy the body, poured over it a pint and a half of vitriol, and then covered it with fresh-burnt lime, which was slaked upon it; but the body was disinterred, and all the facts necessary to show that the deceased had been murdered were clearly brought out.

Lime is frequently used under the erroneous impression that it destroys organic matter. Unslaked lime, if placed on the body and freshly slaked, will develop a considerable amount of heat. This heat is insufficient to cause destruction, but, on the contrary, it has a tendency to delay putrefaction and to preserve the body. Slaked lime and chlorinated lime have also been used in an attempt to destroy tissues, but they act as antiseptic substances and thus inhibit the growth of micro-organisms and delay destruction of the body.

A stiff cream of lime has no corrosive or caustic action on the skin or muscles; its chief use in the tanning of skins is not to corrode them, but to combine with and remove the fatty portions.

It will be noted that all the above substances are now recognised as antiseptics, with great powers of destroying microbes when used in sufficient strength. Lime is not likely to promote the growth of putrefactive bacteria, but, on the contrary, is likely to inhibit it.

8. **Influence of Burial in Earth.** In the remarks about putrefaction will be found facts which help to explain the variations which are found in buried bodies. Apart from these data, there is little or nothing to add to the author's original exposition of the subject, which is reproduced practically intact.

Exhumations are occasionally required for the purposes of justice, and it is in these circumstances that opportunities may occur for observing the progress of putrefaction in the dead. Unfortunately the results of these observations have hitherto led to no satisfactory conclusions, for sometimes one body has been found more decomposed after six or eight months' burial than another which has lain interred for a period of eighteen months or two years.

From facts hitherto collected, especially from the researches made by Orfila, it would appear that the changes which take place are similar to those described in speaking of putrefaction in air.

There is in the first instance a discoloration of the skin of the abdomen, owing to decomposition taking place more readily in the contents of the viscera. The skin of the whole body becomes green, and the epidermis loose and easily detached by pressure or friction. The muscles also acquire a dark green colour, become more or less pulpy, and in the course of time lose their fibrous character. The lungs are distended with gases, and completely fill the cavity of the chest. The heart and liver are softened, and acquire a dark slate colour. The same change is observed in the spleen and kidneys, the fat around the latter organs being commonly white and firm. The whole of these organs will be found much reduced in size. Thus the liver may weigh no more than a pound or twenty ounces. The surfaces of the soft organs, especially of the liver, frequently present small circular patches of a hard white crystalline substance, which is insoluble in water. It consists chiefly of crystals of phosphate of calcium with organic matter, and in some instances associated with triple phosphate of ammonium and magnesium. The author has found these crystalline deposits in bodies which have been exhumed at periods varying from one to three years after interment. When the process is further advanced, the soft organs are filled with vesicles of gas, and float on water. The stomach, intestines, and urinary bladder have their mucous surfaces stained with patches of a brown, green, or deep slate colour. Sometimes these stains are of a coally blackness. The coats of the stomach, if entire, may be closely adherent. They are very thin ; difficult to separate, and are frequently ruptured in the attempt to examine them. All the contents may have disappeared with the exception of a thin layer of a black substance, which is probably decomposed blood. The lining membrane is sometimes covered with deposits of small hard crystals of phosphate of calcium, or phosphate of ammonium and magnesium. These must not be mistaken for crystals of white arsenic. The stomach and intestines may be stained a deep orange or yellow colour with bile. This may be identified by its forming a green-coloured solution when boiled in hydrochloric acid. The marks of irritant poisoning, and those pathological changes in the viscera so characteristic of death from poison, are now lost in the discolorations produced by putrefaction. As the process advances the body becomes covered with fatty incrustations of a reddish brown colour, and the interstices are filled with the common blue, white, or green mould, intermixed with another reddish-coloured fungus. The skin and soft parts become thin, and fall off in places, and expose the bones. The coverings of the chest and abdomen are so collapsed as to be in contact with the anterior portion of the spine. The muscles are considerably reduced in bulk ; and they may be found in part converted into adipocere. The viscera are also much shrunk, collapsed, and often, if we except the stomach and duodenum, so intermixed that it is not possible to identify or separate them. The liver may in this way be found incorporated with the lungs, owing to the destruction of the diaphragm, and the brain completely collapsed. In one exhumation, after four years' burial, the whole of the soft parts of the chest and abdomen formed a soft whitish yellow mass disposed in condensed layers. It was impossible to distinguish the stomach from the liver, intestines, or lungs.

In the case of Peter Mawer, whose remains were exhumed at Boston after eight years' burial in a damp grave, the body was in fragments, the soft parts loosely adhering to the bones, immersed in a large quantity of water in the coffin. The muscles, soft organs, and skin were converted into a white sodden mass in which no organ or part could be identified. The mass had a fibrous structure ; it contained oily matter, and had a very offensive odour, like decayed cheese. The bones were of a dark colour ; they could be drawn perfectly clean out of the soft parts. The water of the coffin contained phosphate and sulphate of ammonium, with animal matter.

At this period the features are entirely destroyed, and the form of skull and skeleton generally is apparent. In a still more advanced stage, scarcely any traces of the soft organs are to be met with. The muscles, if not already changed as above described, pass into the condition of brown foliaceous masses. This is chiefly observed in those bodies which have been buried in a dry gravelly soil. The bones are disarticulated, the long bones giving the perfect outline of the skeleton, while the short and flat bones, including the bodies of the vertebræ with the base of the skull, are converted into a brownish white pulverulent mass, mixed perhaps with the friable remains of the wooden coffin in which the body was buried.

It has been found impossible to assign any definite period of time to these changes, or, from an observation of them, to give any certain opinion respecting the length of time for which a body has been interred. The reason is obvious : bodies undergo these changes with very different degrees of rapidity, even when they have been interred in similar circumstances.

In one body which had been buried for nine months, and in another for thirteen months, there were no traces of the coverings of the abdomen ; in a third, these coverings were found almost entire after a burial of twenty-three months ; yet these three bodies had been wrapped in cloth of the same texture, and buried side by side in coffins made of the same kind of wood (Orfila). In the removal of the remains of about two thousand bodies from St. Andrew's churchyard in connexion with the construction of Holborn Viaduct, some bodies were found well preserved. They were mummified, dry, and like tanned leather. In one case, that of a man, the clothes were perfect ; in another, that of a lady whose body had been buried for over a century, the lace on the grave-clothes was perfect and only slightly changed in colour.

It is commonly said that the soft parts are entirely destroyed in a period of from seven to ten years ; but this must depend on the circumstances in which the body is buried, *i.e.*, the kind of coffin, the nature of the soil, and the depth of the grave. Devergie states that in one instance he met with no trace of a shroud in a body which had been buried three years and a half, while in another a portion was discovered after seven years' interment. Taylor had an opportunity of examining a grave in which a body had been buried twenty-five years.

Soft fragments of the coffin of a dark brown colour were found, but of the body only the skull (excepting the base) and some portions of the long bones remained. In an adjoining grave, nearly the entire skeleton was discovered lying at full length, surrounded by the decomposed coffin. This was after thirty-four years' burial, and the bones were nearly all perfect. He also found here traces of the shroud on the inside of what had been part of the coffin-plate, and the texture of linen was made evident by submitting it to the microscope.

Unless the body had been buried in metal, or converted into adipocere, it is not probable that any of the soft parts will be found, in a soil favourable for decomposition, after ten or twelve years. They may exist as a form of unctuous fat mixed with the wood and earthy matter, but they are not likely to be in a condition to admit of identification. The usual period for the destruction of the soft parts of a body interred in thin wooden coffins may be taken at about ten years, but the type of soil and the temperature are important factors, for example, in hot climates the soft parts may disappear completely in a few months.

In most instances of official exhumation the period of interment is well known, and no opinion is required of a medical witness on this matter. The only case on which he may be called upon to give an opinion is where a skeleton or some bones have been discovered lying loosely in the soil. The bodies of persons who have died by a violent death are commonly buried superficially in loose ground without a coffin ; hence the data obtained by examining the progress of decomposition of bodies placed in coffins even if they were more precise, could not be of much value in the cases mentioned. As the teeth, the bones, and the hair are among the most indestructible parts of the body it will be necessary in an exhumation to look for any portions of these that may remain. They often throw light upon the age and sex of the individual, and serve to determine, questions of identity (*vide* " Identity ").

The circumstances which modify the progress of putrefaction in the earth may be in some measure anticipated from what has been already said of this process in air. Among them may be enumerated the period during which the body may have been exposed to the atmosphere before interment, the nature of the soil in which it is buried, and the depth of the grave, with other circumstances, the precise influence of which it is difficult to estimate.

Date of Interment relative to Death. It is well ascertained that a body putrefies much more rapidly in air than in any other medium ; hence, if it be kept long exposed before it is interred, putrefaction will take place more readily, and advance to a much greater extent, than if it had been buried soon after death. If a body be kept exposed during the summer for five or six days, and then interred, it may be found on exhumation, after the lapse of a month, that putrefaction is as far advanced as it would have been after the lapse of several months supposing that the subject had been interred within a few hours after death. Owing to this circumstance, there is a difference in the rapidity of decomposition according to whether the bodies on which the observations have been made were interred after exposure to a hot and moist or cold and dry atmosphere.

Nature of the Soil in which the Interment takes place. If the ground is elevated or on an acclivity, it will commonly be dry, and decomposition will be retarded ; if a body is buried in a low situation, or in a valley, the soil being generally damp, decomposition will be hastened. A dry and absorbent soil retards putrefaction ; and thus bodies buried in the sands of Egypt become often perfectly desiccated, and resist the process for hundreds of years. The chemical nature of the soil also has an influence which may be briefly stated. In sand, gravel, or chalk, putrefaction goes on more slowly than in other soils, and adipocere is rarely met with, unless there is free access of water, when that portion of the body exposed to the contact of water may become adipocerous. In marl or clay, if air has access, the process takes place more quickly, especially in loose mould or in any porous soil much impregnated with animal or vegetable matter. It is in these last-mentioned soils, provided they are not too dry, that the formation of adipocere is observed ; and however great the rapidity with which putrefaction may have advanced previously, it is either suspended or modified on the formation of adipocere. By a reference to the nature of the soil, therefore, we may often explain why a body, after having been interred for a considerable number of years, may be exhumed apparently unaltered by decomposition. The whole of the soft parts may have become converted into this substance ; but although the physical outline may be preserved, the texture of the organs will be completely changed (*vide* " Adipocere ").

When a dead body is immersed in a liquid of a preservative nature, as in the water of a peat-bog, the changes which take place are of a peculiar kind, and they render it difficult to arrive at even an approximate conclusion respecting the period of death. A male human skeleton was found near the surface of a peat-moss or bog. All the bones were detached, and were of deep chocolate colour. The right femur had been accidentally fractured obliquely, and the skin and muscles were closely adherent to it. They were free from any unpleasant odour, and were completely tanned. The bones were destitute of phosphate of calcium, and in consequence were flexible as cartilage. It was supposed that the person had been shot and the body deposited in the bog ten years previously, but it might have been lying there fifty years. The removal of the phosphate of calcium was a remarkable fact ; it probably depended on the action of the vegetable acids in the peat water. Tannin was, no doubt, the agent by which the soft parts were preserved.

Depth of the Grave. Observation shows that the deeper the grave the longer putrefaction is retarded. This may depend upon several circumstances, such as the want of free access of air in deep graves and the uniformly low temperature which is known to prevail, at all seasons of the year, at a certain depth below the surface of the soil. Bodies buried in shallow graves are subject to the fluctuations of temperature which take place during the day and night, and throughout the seasons of the year ; they are therefore most favourably placed for the rapid progress of putrefaction. According to the most accurate observations, the diurnal changes of temperature extend to about two feet or less in depth below the surface, while the seasonal changes are perceptible to the depth of six feet. Bodies buried below this depth putrefy slowly, *cæteris paribus*, owing to the uniform and comparatively low temperature which is there maintained. As in these cases there is no free access of oxygen, ammonia and sulphuretted hydrogen are abundant products of decomposition. The exposed parts of the skin are soft, completely brown, like the skin of a mulatto, and the limbs, as well as the face, are thickly covered with a soft white fungus. Such has been the condition of bodies when exhumed after an interment of from one to two years.

The State in which the Body is buried. Putrefaction is more rapid in bodies buried naked than in those which have been buried wrapped in clothes. This point may be a subject requiring especial attention in investigations relative to infanticide, since the bodies of children are often thrown naked into a pit and loosely covered with earth. The process is less rapid when the body is interred in a close coffin ; and when the latter is formed of an imperishable material, such as lead closely sealed, putrefaction is speedily arrested ; and the deceased may be recognised after the lapse of many years.

Upon examining the body of an elderly woman seven months after death the cause of death was ascertained to be mitral stenosis and pneumonia ; the fibrous valve had not undergone any putrefactive process, and the solid condition of one lung was quite distinct from the natural feel of the other. All the organs were identifiable, and were healthy

5. Observed Facts in the Order of Putrefaction of the Internal Organs

There can be no doubt that some organs are more resistant to putrefaction than others. No absolute reliance can be placed on such data, but the order in which they commonly putrefy may occasionally be of some little assistance in helping to determine the date of death, and it is therefore worth while to insert the following table for reference.[1]

Organs which putrefy early, approximately in the order given.

Larynx and trachea bright red or greenish in three to five days.	The larynx is an open tube, kept so by its cartilages, and hence allows an easy entrance to microbe-laden air.
Brain of infants soft and pulpy in four or five days or less.	The scalp is very thin and the bones of the calvarium are not very close together nor fixed. It is probable also that the organic material is so complex that a little decomposition makes a great show.
Stomach and intestines show signs in five or six days.	These organs during life contain an enormous number of microbes which can initiate decomposition. The cæcum is probably the best circumstanced as regards warmth and degree of moisture, etc., and hence the green patch over it is a very early sign.
Spleen soon becomes soft and dark.	Probably by reason of its blood-content.
Liver soon superficially discoloured, but may remain firm for long periods.	Is a solid organ of stable enough constitution.
Brain of adults firmish for a week or two.	Better established in its constituents than the infantile, and also rather better protected. Miss Holland's brain was still recognisable four years after burial in four feet of earth. (see p. 164).

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[1] Cp. 1 Casper, E. Tr., p. 38.

Organs which decompose later, again approximately in order.

Heart quite distinguishable for months.	This doubtless varies, as in deaths from septic diseases it may soften even in forty-eight hours.
Lungs. Often very early gas bubbles may be seen between pleura and lung, but no further decomposition even for months; then they turn green and black.	Probably associated with the demonstrated fact that the air in the alveoli is aseptic, except, of course, in disease.
Kidneys and bladder.	May also be partly explained by the fact that healthy urine is aseptic In the case of Miss Hickman and also of Miss Holland the kidneys had resisted putrefaction longer than the uterus. (pp. 164 and 215).
Œsophagus.	A closed tube without access of air and swept clean by swallowing.
Pancreas.	A solid organ.
Diaphragm.	Muscles decay rather slowly in general, possibly owing to their solidity.
Blood-vessels.	Probably owing to the resisting power of elastic tissue.
Uterus was " red, firm and normal " in a body after nine months in a cesspool. Casper found it virgin in size, unimpregnated and empty.	This must depend upon circumstances. The puerperal uterus decomposes rapidly, more so if puerperal infection has been present.

It is worth while also to draw attention to the differences which are apparent in the order of external signs of decomposition between bodies which have remained in the air and those which have been in water.

6. THE DIFFERENCES OBSERVED BETWEEN BODIES LEFT ON LAND AND THOSE FOUND IN WATER

The order of the superficial appearance of the colours of decomposition is said to be different.

Water	In order of appearance from above down.	*Air*
Face and neck, or sternum.		Abdomen.
Shoulders.		Chest.
Arms.		Face.
Abdomen.		Legs.
Legs.		Shoulders.
		Arms.

The researches on drowning made by Casper and Kanzler show that, while the lower part of the body may be in a tolerably fresh condition, the face, head, neck and upper part of the chest may present a reddish colour passing into patches of a bluish green, first seen on the temples, ears, and nape of the neck, thence spreading to the face, and afterwards to the throat and chest. These changes may be observed in summer when a body has remained in water from eight to twelve days, and in winter for a longer period. The head of a drowned person is sometimes much discoloured from putrefaction when the rest of the body is in its ordinary condition.

The head of a submerged body floats lower than the rest of the body; hence blood gravitates first to the head and neck. This explains the early external appearance of putrefaction in this part of the body.

Decomposition undoubtedly takes place more slowly than in the atmosphere, owing to the low temperature and to the fact that the free access of air is cut off. The skin covering the palms of the hands and the soles of the feet is found thickened, white, and sodden from imbibition when the body has remained several days in water. Owing to this cause, ecchymoses resulting from violence during life are not always apparent in a body at the moment it is removed from water; it is only when the skin has lost the greater part of the water by evaporation that ecchymoses and other marks of violence begin to show themselves. The influence of air upon the skin of a body which has been for some days submerged is chiefly seen, after its removal from water, in the face and chest. In a few hours, if the temperature of the atmosphere be moderately high, the face may be found bloated, and either livid or black. The features are so distorted that they cannot be recognised by those who knew the person during life. The change chiefly occurs in the skin, which becomes first of a livid brown colour, and afterwards changes to a deep green. The discolorations are chiefly apparent in those parts which are freely exposed to the atmosphere. They are not commonly found on surfaces which have been in close contact, as in the armpits and upper and lower limbs, where the former have been closely applied to the sides of the body, and the latter have remained in close proximity to each other. For the same reason the discolorations are not commonly met with at the back of the body, or on those parts which have been closely wrapped in clothes.

Gaseous putrefaction takes place in bodies immersed in water, as well as in those which are exposed to air. The abdomen, chest, and cellular membrane beneath the skin are distended; the body acquires buoyancy and rises to the surface. It requires but a very slight expansion of the cavity of the abdomen for this effect to follow, since the human body is only slightly heavier than its bulk of water. The position in which a dead male body floats is commonly with the abdomen or back on the surface, and the head with the upper and lower extremities depending. The bodies of females, it is said, are more commonly found floating with the abdomen upwards. The period of time required for a body to rise to the surface, from gaseous putrefaction, must depend on many circumstances. It is stated to happen usually from the third to the fifth day after death from submersion or from the eighth or ninth day in deep seawater. The gases may be then liberated, and the body will sink; they may be again generated, and it will rise. The facts connected with the buoyancy of the dead body became of great importance in the trial of Spencer Cowper[1] (1699) for the alleged murder of a woman (see "Drowning"). If the dead body had been submerged for some weeks or months, or has remained long exposed before inspection, the skin will be found of a deep blue, black, or green colour, the muscles soft and discoloured, or the fatty parts may have been converted into adipocere. Ultimately the soft parts will be washed from the bones, and the skeleton separated.

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[1] "Famous Trials of History," Birkenhead, 1926, p. 89.

The changes from putrefaction in the drowned or apparently drowned, even when comparatively slight, may, as Casper justly remarks, seriously affect the value of medical evidence. The blood becomes decomposed, acquires a darker colour, and produces the appearance of congestions in the brain, lungs, right side of the heart, and other parts of the body, so as to render it difficult to form a conclusion on death from apoplexy or asphyxia.[1]

Attempts have been made by the aid of baths of formalin, chlorine, salt, and hydrochloric acid, as well as by injections of chlorine, chloride of zinc, and ferric chloride, so to restore the features of a drowned body as to enable persons to identify it. After the occurrence of such changes from putrefaction in the drowned as those above described it is extremely difficult to restore the features. It is one thing to arrest or prevent putrefaction by these agents, but another to suppose that the chemical changes can be reversed, and the corpse put in the position of a body recently drowned. It may be well to state here that mistakes have frequently been made by persons relying upon the features as proof of identity in the drowned.

Hollis v. Turner was a singular case of this kind in which it was sought to establish the death of one William Turner. This person was of restless, unsettled habits, wandering about the country, and in a state of great mental and bodily depression. On May 7th, he walked into the house of some people named Waller at Guildford, He was shivering with ague, covered with boils and sores, and had a fortnight's unshaven beard. His sores were dressed with rags. On the following day he left the place, and was never again seen alive. Ten days after his disappearance the body of a man much decomposed was found in the river Wey, near Guildford. At an inquest held on the same day, two men, named Etherington claimed the body as that of their father, who was missing. Mrs. Waller and others saw the body, and stated their conviction that it was the body of Turner. The body, however, was buried as that of Philip Etherington, a ragged piece of neckerchief having been previously removed from the neck. Some months afterwards Etherington, sen., the supposed deceased, walked into his daughter's house. It was therefore clear that the sons must have been deceived as to the identity of their father. There was no doubt that this was the body of Turner. A fragment of an old neckerchief, found under the bed where this man slept on May 7th, corresponded exactly with that which was removed from the neck ; and further it was remembered that there were sores on the body, which had been dressed. The Court held that the evidence adduced was sufficient to identify the body found in the river Wey as that of Turner, and an order was made accordingly.

The case of Miss Hickman, M.D., created so much interest and is so *apropos* of decomposition, that the account of her inquest[2] is inserted in detail.

An inquest was held at the Police Court, Richmond, on Wednesday, October 21st, by Dr. Taylor, J.P., the district coroner, on the body found in Richmond Park, which was alleged to be that of Miss Hickman, whose mysterious disappearance for nearly two months had excited great interest.

A maid employed at the house of Miss Hickman's father identified by the marks thereon the clothes produced as having belonged to Miss Hickman. She also identified a watch and two bronze medals, one granted by the St. John Ambulance Brigade, upon which the name of "Fanny Hickman" was engraved, and the other a medal won by her young mistress.

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[1] 1 Casper, 219

[2] *B.M.J.*, 1903, 2, p. 1105.

Several little boys, of ages varying from nine to twelve, deposed that on October 18th they had been hunting for chestnuts in a game-preserved part of the park, and that whilst searching in the heavy undergrowth they had suddenly come upon the body of a woman.

Inspector Cleeve and several sergeants of police detailed the steps they took upon receiving the information that a body had been seen in a plantation in the park, and how late at night they instituted a search party, and after much difficulty traced the whereabouts of the body in consequence of the smell. They also related the result of a further search of the ground when daylight appeared, at which time they were able to find the various articles described by the maid, and also an empty medicine bottle, unlabelled and uncorked. They also stated that it would have been impossible for less than four people to have lifted the body over the fence surrounding the plantation, and explained that even as it was it required several constables to remove the body when found. They also negatived the idea of foul play.

Examination before Removal. Dr. Gardiner said: "On Sunday, October 18th, about 10.30 p.m., I was summoned by the police to view the body of a woman that had been lying in one of the plantations in Richmond Park. The police required me to see it previous to removal. I went to the plantation and saw the body. The body was lying on the ground as near as I could guess about eight yards from the iron fence which surrounded the plantation, and was covered by the leaves and boughs of rhododendrons. The body was lying on the left side and slightly prone, the head pointing towards the direction of Richmond Hill. The left arm was fully extended at right angles to the body palm up; the right arm was across the chest and tucked in below the left breast; the thighs were flexed slightly upon the abdomen, the legs flexed upon the thighs. The left leg was drawn up more than the right, and the right ankle was in the hollow of the left foot. The body was clothed, and the clothes were in no way disarranged. The head was separated from the body, and lay about five or six inches away and slightly behind the middle line; it was turned up as if looking over the right shoulder. The head and face were denuded of all soft parts with the exception of a little integument on the occipital bone. The lower jaw was detached and lying a little in front of the middle line of the body, partly covered by leaves, and partly by a large straw hat, which was lying upon and among leaves, crown up. The lower jaw was devoid of tissue, and several teeth were lying beside it, having dropped from the jaw. The neck appeared to be gone, but in the line of the neck, and close to the body, I found the second cervical vetebra. The hands and feet appeared to be gnawed. Such examination as I could then make showed no signs of violence. The body was lying under boughs. No boughs appeared to be broken beneath the body. The position of the body was as if the deceased had lain down to sleep or rest. The bushes formed a thick screen above and around. The body appeared well nourished, and that of a large and powerfully built woman. There was a pad of hair lying on the ground between the skull and the lower jawbone."

Post-mortem Examination. Continuing, Dr. Gardiner said: "I made an examination later at the mortuary. I performed the *post-mortem* examination, assisted by Dr. Saward and in the presence of Mr. Pepper. The body was well nourished; no parts of the body exhibited marks of violence such as fractures of bone, bullet wounds, or cuts. The body was much decomposed; the skin in many places was absent, being apparently gnawed away. The head was entirely detached, the cervical vertrebræ all detached with the exception of the seventh; all the other cervical vertebræ were missing with the exception of the second. The skull was denuded of all soft parts, and exhibited no fractures and no wounds, bullet or other. The face was long and oval: the upper and lower jaws when placed in position were opposed; many of the teeth in both jaws had dropped out; some were stopped with gold, and others with amalgam. The brain had gone. The hair was coarse and brown in colour, tied up behind with tape and fixed with ordinary hairpins, and was about seventeen inches in length. The skin had been gnawed away in front of the chest to the bottom of the breast bone. The skin and soft tissues of the neck and shoulders were completely gone; the clavicles and first ribs were exposed. On the left side the soft tissues of hand and wrist were gnawed away, as also the skin of the lower half of back of the forearm. The fingers were missing, except part of the middle finger, and of this only the metacarpal bone was left. The skin of the right arm was gnawed away in the lower third of the dorsal aspect, and from the lower two-thirds of the palmar aspect of the forearm. All the fingers were missing. The skin and muscular tissue of the right lower limb were gnawed away, also the upper third of the leg, also the front and outer side of the ankle opening into the joint. The toenails were detached ; that of the great toe was *in situ ;* nearly all the epidermis of the sole was gone. The skin of the left lower limb had been gnawed away on the lower half of the leg ; the skin of both legs was marked by the ribs of the stockings ; the knees exhibited longitudinal ribbing due to the underclothing. The epidermis of the left sole was peeled forwards and stained black. The skin on the outer side of the abdomen and right hip was mottled green, less so on the left. A portion of the breast was left. The uterus was present, and was virgin. The liver, spleen and right kidney were entirely gone, as also the greater part of the intestines. The stomach was just discernible, the only contents a reddish brown layer adherent to the walls, but it was impossible to ligature it. The left kidney was fairly well preserved in its capsule ; the cortex and medulla could be recognised. A small part of the small intestine was healthy. The heart muscle and chordæ tendinæ could just be recognised ; the lungs were shrunken, and formed a pultaceous mass ; the tongue, pharnyx, larynx and œsophagus were all gone, also the trachea. The teeth found were all natural, one or two stopped with gold and two built up with an amalgam made of oxyphosphate ; no false tooth was found. The bones found were digital phalanges, cervical vertebræ, and the hyoid bone. The knife found was a common scalpel, had no maker's name upon it, and was not similar to those which were possessed by Miss Hickman. There was rust upon the knife, partly old and partly new."

Conclusion. " My conclusion after careful examination is that Miss Hickman has been dead for about two months. I am of opinion that there is no evidence that death was due to external violence or to starvation. I am of opinion that Miss Hickman entered the plantation alive, and lay down in the spot where she was found. I cannot give the cause of death, as the result of both examination and dissection is entirely negative. I have preserved the left kidney and portion of the small intestine, and hold these for analysis should it be decided to examine them chemically. The height of the body, making all allowance, would be about five feet nine inches. The missing vertebræ may be lying deep down in the soil or have been carried away by animals. The greatest agency in the detachment of the head was decomposition, the rest due to the gnawing away of parts by animals. I have no doubt about this ; it was not due to violence."

Mr. Pepper, M.S., F.R.C.S., Lecturer on Medical Jurisprudence at St. Mary's Hospital, corroborated all the evidence given by Dr. Gardiner. He mentioned that on the inside of the medicine bottle produced was a greenish deposit, freely movable, but he could not without analysis state what it was, nor could he add to the medical evidence already given.

The coroner decided to adjourn the inquest for two weeks to enable the police and others to finish their enquiries ; but before closing the court desired the jury to express their opinions as to the identity of the body, in order that he might issue order for burial.

The jury unanimously decided that the body which they had seen that day, and upon which the inquest was held, was that of Sophia Frances Hickman, M.D.

For Sir Thomas Stevenson's evidence and analysis in the case, *vide* " Morphine Poisoning," Vol. II.

11. Formation of Adipocere

The formation of adipocere and mummification are the last two changes that bodies undergo after death that need to be described. They belong to a category rather different from putrefaction proper, but as bodies thus converted do ultimately disappear, they strictly are stages in the disappearance, if not in the putrefaction, of a body.

The substance called *adipocere* was first observed and described by Fourcroy during the removal of vast numbers of bodies from the Cimetiere des Innocens in Paris. He gave to it this name, owing to its properties being intermediate between those of wax and fat. He considered it to be constituted of fatty matter and ammonia. The composition of adipocere does not appear to be uniform; it is liable to vary according to the nature of the medium to which the body has been exposed. Orfila suggested that in the first instance an ammoniacal soap was produced, and that this was subsequently converted into a calcareous soap by contact with calcareous water. He stated that he experimentally established this point by macerating ammoniacal soap in a solution of sulphate of calcium. In three weeks he found that a calcareous had been substituted for the ammoniacal base.

Properties of Adipocere. Taylor has given an account of his examination of this substance as it is found in bodies after long interment in damp graves, and his description of its properties is here subjoined. A man died and was buried at Boston in October, 1854, and his body was exhumed for judicial purposes in June, 1862. The white substance into which all the organs had been completely transformed was unctuous to the touch, and had a peculiar and highly offensive odour. When completely dried it was soft, white, somewhat brittle, with a fibrous structure, and crumbled under the knife. Examined by the microscope, it presented none of the usual characters of muscular fibre. It appeared to be a confused network of fibres cemented by a white fatty-looking substance without trace of organised structure. It had a disagreeable rancid **odour**, which was increased when the substance was heated. It was in great part dissolved by **alcohol,** and the solution became opaque on adding water to it. It readily floated on **water,** forming an opaque solution when boiled, and the greater part was dissolved, but the liquid did not become clear on filtration. The solution had a slightly acid reaction to litmus paper. When heated with **potash** it became clear, and evolved ammonia. The substance was almost entirely soluble in potash, and the solution gave a white precipitate with acids. It was only partially fused at 212° F. When **heated** in a close tube, it gave out an offensive rancid odour, evolving ammonia and traces of sulphur compounds; it readily melted, and by continuing the heat a dense oily vapour having an acid reaction distilled over, a carbonaceous residue being left in the tube. When heated on platinum it melted, took fire, and burnt with the bright yellow flame of a hydrocarbon.

Rutter and Marshall[1] give the chemical composition of hard adipocere as follows:

	Per cent.
Palmitic acid	67.52
Stearic acid	3.3
Oleic acid	5.24
i-Hydroxystearic acid	9.48
o-Hydroxystearic acid	6.32
Stearin and palmitin	1.21
Olein	0.16
Unsaponified matter	0.87
Calcium soaps	4.41
Protein	0.665
Ash	0.578
Humus and undetermined	0.247

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[1] *Trans. Royal Society, Canada*, vol. 10, 1916, 169; *Jour. Biolog. Chem.*, vol. 29, 1917, 319.

As a result of their investigation it is clear that adipocere is essentially composed of saturated fatty acids, glycerides being present in traces only.

They state, *inter alia* : " Adipocere should be regarded as the product of the hydrolysis of fats by water where the time factor and the concentration of the reacting water are almost indefinitely great, and where the soluble product glycerol is rapidly removed. It seems that bacterial and enzymic action and the formation of soluble soaps play a quite secondary part in the development of adipocere from fats. The hard waxy character of the mature substance is largely due to the presence of the two hydroxystearic acids. Calcium soaps, proteins, etc., are variable incidental components."

Close experimental study of adipocere formation shows that it is undoubtedly formed from pre-existing fat which gradually hardens as the muscular and other tissues disappear. There is a suggestion that a certain amount of fat is liberated from the decomposing proteid, but this is of little importance. The change does not occur in the absence of decomposing protein, hence bacteria or their enzymes must play a part in its production.

Though it is possible that an ammoniacal soap may be formed in the early stages, this is not an essential change, for adipocere may be formed experimentally in a medium with an acid reaction.

Where Adipocere is formed. Any part of the human body may undergo this change, but all parts are not equally susceptible of it. In order that adipocere should be found, it is indispensable that the animal fat should be in contact with substances containing nitrogen. Experiment has clearly established that neither pure fat nor pure fibrin, when kept apart, will become thus saponified. Orfila found by comparative experiments that the skin deprived of all fat did not undergo this change, but when the fat was allowed to adhere to it became saponified. Those parts of the body which contain the most fat, such as the cheeks and buttocks, are the first to be formed into adipocere, but under suitable conditions the whole of the subcutaneous fat may undergo the change. The internal organs do not appear to undergo this transformation. When the change is complete, the body maintains its condition for many years. Thus in one instance, after seventeen years' burial in a grave, an exhumed body was found to be converted into this substance, and many of the organs could still be identified.

Time Required for its Formation. To make an endeavour to determine this is of more importance than may appear at first sight, since a legal question of survivorship, in at least two cases, has turned upon the shortest period required for the production of true adipocere in the dead body.

The following also illustrates its importance.

The deceased, who was in a state of insolvency, left his home on November 3rd ; and on December 12th following—*i.e.*, five weeks and four days after his departure—his body was found floating in a river near the place where he resided. A commission of bankruptcy had been taken out against him a few days after he was first missed and before it was known that he had destroyed himself. It became, therefore, important to determine whether he had drowned himself (for there was no doubt of his having committed suicide) *before* or *after* the date of issuing this commission. If it could be shown that he was already drowned when it was issued, the commission would be void in law and his property could not be seized under it.

> The litigation then turned upon the question whether he had drowned himself on the day of his leaving his house, or at some subsequent time. The body was found floating with the head and feet submerged. On being taken out the face was covered with a muddy slime. On the day before the inquest three medical men examined the body with a view to ascertain whether any change had taken place in it which could justify an opinion as to the time during which it had been lying in the water. The muscles of the buttocks were found to be converted into a fatty substance, very much resembling suet (adipocere). The face was completely disfigured by putrefaction. The hair of the head was separated from the scalp by a slight pull. The other parts of the body were firm and white, without any putrefactive appearance.
>
> A medical witness for the plaintiffs stated it as his opinion that the body could not have been less than *six weeks* submerged. Three or four weeks would not have sufficed to produce the appearances met with; the adipocerous state of the body could not have been brought about in *less* than six weeks. He admitted that he had met with an instance in which a body taken from the Severn had a spermaceti appearance within a shorter time, although the change had not advanced so far as in this instance. Another witness supposed the body must have been under water for more than six weeks; he therefore thought the deceased's body must have been in the water during the whole time that he was absent. If it had been exposed to the air it would not have presented the appearances met with. He admitted he had said that the body was in such a state that it would be impossible to express an opinion. Gibbes had been able to procure a small quantity of adipocere from muscle by maceration in water for a *month*. Upon this evidence, the jury were of opinion that the deceased was not alive at the time the commission was taken out, but that he had been dead for the whole period of his absence, and the bankruptcy was accordingly superseded.

Taylor commented on this as follows:

> In medicine as in law, there are always two sides to a speculative question. The case, *prima facie*, as we have seen, was in favour of the plaintiffs. The state of the body supported this view, although it might have been contended for the defendants that a few days more or less would have made no difference in the results, and that deceased might therefore have been alive when the bankruptcy was declared. The verdict of the jury was physiologically well founded. The general period required for the production of adipocere in drowned bodies is stated by most observers to vary from three or four months to a year. Its occurrence in a body to any extent within five weeks and four days must be regarded as an exception to an extensive series of observations. The witnesses for the plaintiffs were then justified in assigning the longest possible period that the circumstantial evidence would admit for its production in this instance. The facts of this case show that adipocere may be produced in the body of a drowned subject within a period of six weeks. The defendants wished to make it appear that the adipocerous transformation might take place with much greater rapidity, but there were no facts to render this view probable, while there were many facts in support of the contrary opinion.

It seems a reasonable deduction to draw that the time of its appearance is governed first by the general rules which govern the decomposition of the body, and secondly by certain special circumstances which are necessary for decomposition to occur in fats and nitrogenous tissues, at periods appropriate for the formation of the substance in question. Beyond this very general statement is seems impossible to go in the direction of determining with accuracy whether it ever will occur or when it will occur, and we can only record facts as they have been ascertained and which undoubtedly follow within some reasonable distance the above suggestions; thus it is much more speedily formed in tropical than in temperate climates and in hot weather than in cold.

It takes place most readily—(1) in the bodies of young persons, the fat being chiefly superficial and very abundant; (2) in those adults whose bodies abound in fat ; (3) in bodies exposed to the soil of water-closets ; (4) in those immersed in water, but somewhat less rapidly in stagnant than in running water ; (5) in humid soils, especially in graveyards where numerous bodies have been piled in contact with each other. In this latter case, those which are situated at the lowest level have been observed to become the soonest saponified.

Devergie has shown that the fat of the female breasts, that of the hollow of the cheeks and other large fatty accumulations, are the first to take on this change, while the fatty layers immediately in contact with the muscles present no appearance of saponification until a considerably later period.

With regard to the period in an ordinary grave, the case of a female exhumed at Bristol in 1835 after fourteen month's interment may be referred to. The lower part of the body was found adipocerous. It appears that the grave was very damp, and the line of adipocerous transformation in the deceased was bounded by the level to which the water had reached.

A slight change in the fat may be observed after about three weeks' immersion in the water, but to obtain definite conversion in an adult limb about three months at least is required.

With reference to its formation in tropical climates, Dr. S. Coull Mackenzie in 1889 published[1] a series of eight cases of saponification which he had met with during nine years' medico-legal work in Calcutta. The first case (August, 1880) was in " an advanced state of saponification " and was found in a tank, having lain there apparently " for several days." The second case was the body of a syce, exhumed from a damp Mahometan burial-ground four days and four hours after internment ; it was also found to be in " an advanced state of saponification " (July, 1883). The third case was a Chinawoman, whose body was disinterred on 2nd September, seventy-six hours after burial. It was also in an advanced state of saponification. The next five cases occurred in bodies drowned in the Hooghly. The first was a Bengali, drowned in a storm ; the body was examined three days after, and the internal organs were saponified. The second case was a European adult, who fell (September, 1881) into the river ; the body was found after two days, and " all external portions of the body were found to be saponified." The third case was that of a European sailor, who fell into the Hooghly on 6th October, 1883 ; the body was found after eight days and ten hours ; " the external parts and heart, liver, spleen, etc., were saponified." The fourth case was also a sailor, drowned in the river on 2nd February, 1885 ; the body was not recovered for fifteen days, and was " then in an advanced state of saponification." The fifth case was a European youth, who fell into the river on 26th September, 1885. The body was recovered after seven days, and was found to be in an advanced state of saponification.

Dr. Mackenzie wrote : " The first two cases were most interesting as well as instructive, as they show that the conditions obtaining during the rainy season in the soft and porous soil of Lower Bengal, saturated with moisture, and of a high temperature, facilitate the formation, and in three or four days have the power of saponifying the external parts of the body, even though buried in a wooden coffin, as was the Chinese woman Athow.

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[1] *Ind. Med. Gaz.*, 1889, p. 42.

" The last five cases point to the fact that in the river Hooghly during one of the months of the cold season (February) not only the external tissues of a body, but also six of the internal organs, were found to be saponified in a little over fifteen days ; that in one case during the hot season (May) the external tissues as well as the internal organs were saponified in three days. Lastly, in the hot, steamy, rainy months of September and October, in three cases saponification was found both externally and internally from two days to eight days ten hours. In the case of the lad Chapman, the fleshy portions of the undigested food in the stomach were converted entirely into adipocere in seven days."

Nuttall[1] pointed out that Mackenzie's observations were the only ones he could find bearing upon the subject of adipocere formation in hot climates, and they were in opposition to opinions on the subject based on experiences in Europe. He also stated that internal organs are not converted into adipocere unless they have been in a state of fatty degeneration. Dr. Nuttal, while admitting that adipocere may be formed more rapidly at a high temperature, concluded his paper by saying that besides the doubtful observations above noted he could not find any publication mentioning the occurrence of adipocere in warm countries."

In the next issue of the *Gazette* Surgeon-Captain D. M. Moir, I.M.S., challenged Dr. Nuttall's arguments and protested against the way in which he dismissed the observations of such a careful and experienced observer as Coull Mackenzie, and in support of the latter's statement he quoted a case of his own in which he had a body exhumed in October, 1891, near Chittagong, which had been buried *three weeks* before on the banks of a large tank. On exhuming the body Major Moir was pleasantly surprised to find no disagreeable smell, and the body had undergone saponification, so much that he was able to confirm the report of the first *post-mortem* examination in every particular. This body had been buried in the end of the rainy season about three feet deep in the soil, which was alluvium with a substratum of clay, and the soil was moist owing to the rainfall of the previous three months.

Dr. Reginald S. Ashe published the case of a boy aged nine, who was buried on 30th September, 1897.[2] Circumstances led to the exhuming of the body on the fourth day after burial, and Dr. Ashe found the skin of the abdomen, chest, and upper and lower extremities dry, mottled, and waxy-looking, and free from all offensive odour. He sent the heart, some of the omental fat, muscles, and skin, to the Chemical Examiner, who reported that "*very partial saponification had taken place in the tissues.*" Dr. Ashe concluded that " adipocere can begin to form in India four days after death " under conditions, as in this case, where the body was buried in a shallow grave, covered with nine inches of water.

With reference to this controversy it should be understood that changes occur in macerated tissues which often give the impression that adipocere has been formed. If such specimens are dried the resemblance at once disappears. Mackenzie's early cases may have been of this nature. Moir's case was three weeks buried, and therefore had time to form a certain amount of adipocere. Ashe's case cannot be considered adipocere at all.

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[1] *Ind. Med. Gaz.*, April, 1897.

[2] See *Ind. Med. Gaz.*, March, 1898, p. 83.

As a curiosity in the formation of adipocere, it is worth recording that Billroth removed the fruit of an extra-uterine pregnancy *perfectly* converted (bones and tissues) into adipocere, every part being entire. The woman was believed to have been pregnant two years before the operation was performed.[1]

To conclude the subject, it is obvious that if a medical witness is asked a question on the probable date of death, as judged by the amount or distribution of adipocere, his answer must not be too didactic ; he can only consider the conditions to which the body has been exposed and then reply that the condition found would (or would not) seem, according to reported cases, to be consistent with what might be expected for the time during which the body has been exposed to the known influences.

12. Mummification

Mummification of a dead body may be due to natural or artificial causes.

Natural Mummification. We have seen that one of the prime conditions necessary for putrefaction is a sufficiency of moisture in the tissues to enable the microbes to live and continue their work of decomposition. If this condition is not fulfilled the body may undergo the process we are speaking of, and thereby be preserved for a long period of time in an almost unaltered shape ; it may ultimately crumble down into a fine impalpable powder.

Circumstances tending to Natural Mummification. It is reasonable to infer that these imply a free circulation round the body of dry, warm air or the presence of such a degree of heat that the natural water of the tissues is rapidly evaporated. Such conditions are met with in the hot and arid sands of Egypt, or in such circumstances as a body being placed in the roof of a house in a warm atmosphere with free circulation of air. Numerous instances of this kind have been reported. It is much less common to find it in cases where the air might be supposed to be at rest, but Ogston records one case of the body of an infant that appeared perfectly mummified after concealment for one or two years in a dry stone well, and a second case of a similar kind in the body of a child that had been shut up in a box for three months. In a case where two children had been buried in a dry soil for seven months, partial mummification had occurred, in both. This case is complicated, however, by arsenic having been found in the bodies, and it is easy to see that if putrefaction be arrested by any such means mummification might take place from simple evaporation. *Vide* also *supra* "Influence of Moisture on Decomposition."

Artificial Mummification only requires mention owing to the fact that in such manipulations of a body antiseptic substances are used (commonly arsenic and also resinous or tarry material) and might prevent the detection of poison as the cause of death.

SUMMARY OF SIGNS OF DEATH

We have now fully considered the signs of death and the changes which take place in the body after death. We may briefly discuss them in very general terms as indicating the reality of death and as giving proofs of the date of death. We shall then quote several cases of difficulty.

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[1] *B.M.J.*, December 4th, 1880, p. 897.

Reality of Death. Each of the ordinary signs of death have been found to be open to fallacies when considered alone, but in their totality they offer no room for mistake, provided that observations are carefully made over a few hours, and we must express our total disbelief in premature burial, in England at any rate, and also the conviction that it is quite unnecessary to wait for actual signs of putrefaction before admitting that death has taken place.

How long since Death took place. The modifying conditions have been seen to be so very variable in themselves and so doubtful in their *precise* action that in broad general terms it may be said to be impossible so to fix a period of death as to prevent entirely an honest difference of opinion. Nevertheless it is well worth while to insert the following general principles laid down by Tidy[1] :

A. Signs of Death present in Bodies dead at the longest from ten to twelve hours

1. Complete cessation of respiration and circulation.

2. Loss of lustre in the eye, immobility of the pupil, and loss of the normal tension of the globe.

3. Ability to produce contraction of muscles by stimuli, which reaction only continues so long as the stimulus is applied.

4. Extreme pallor (ashy whiteness) of the body (Exceptions: jaundice; the discolorations arising from the action of poisons, tattoo-marks, the edges of ulcers, bruises and wounds inflicted during life, extravasations (as in purpura), etc.)

5. Coldness after from eight to twelve hours, the internal temperature being the best test.

6. A state (strikingly shown in the globe of the eye) of general relaxation and flaccidity (unless *rigor mortis* be present), with flattening of the nates, calves, etc., when subjected to the pressure of the weight of the body or limb in the first few hours.

7. *Rigor mortis* following the above flaccidity and becoming progressively more complete.

8. Hypostases in the dependent portions of the body and of the viscera.

B. Signs of Death present in Bodies dead from two to three days

In addition to the preceding signs (omitting No. 3), we find

9. Coagulation of the blood.

10. Rigor may be present or may have passed off, leaving a condition of flaccidity, together with incipient signs of putrefaction.

C. Signs of Death in Bodies dead for more than three days

Except in very rare cases, there will now be signs of *putrefaction*. Exceptions may occur during very cold weather, or in the case of bodies preserved in ice, also after certain modes of death, or where some method of hindering decomposition has been employed.

When bodies are green from putridity, bloated, and excoriated, the period of death cannot be fixed with even approximate certainty. At later periods mummification or the formation of adipocere may be found.

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[1] "For. Med., p. 119.

It will be seen that these observations of Tidy closely correspond with those previously quoted by Taylor as follows:

> Some French medical jurists have attempted to give a more definite character to these changes in the recently dead body by dividing the interval between the permanent cessation of the heart's action and the commencement of putrefaction into three stages or periods. In the first, the warmth and pliancy of the body and muscular irritability remain; in the second, these conditions are lost, and the body is cold and rigid; in the third, the body is cold and pliant, the muscles are relaxed, and the joints are flexible, cadaveric rigidity having entirely ceased. A fourth period is marked by the access of putrefaction in the appearance of one or more well-known signs indicative of chemical decomposition.

There can be no doubt about the existence of these stages, but when we attempt to define the precise time at which they commence and succeed each other, the subject is beset with great difficulty. Thus, according to Devergie, the first stage ranges over a time which cannot be more closely defined than by stating that the person may have been dead from a few minutes to twenty hours. From the differences observed in different bodies, there would be some danger in fixing these times too strictly; and a medical witness must be prepared to find that in a question of murder counsel for the prisoner will reject averages, and take for the purpose of defence the longest or shortest period of time within which the respective changes have been known to occur. In spite of this objection to medical evidence, it may be convenient to consider the subject in reference to the three stages or periods proposed by Devergie.

> *First Period.* This is characterised by the warmth of the body being more or less preserved, and by a general or partial relaxation of the voluntary muscles. In such a case as this, after attentively considering the various circumstances special to each which may have retarded or accelerated the cooling of the body, an inference may be drawn that death has taken place from a *few minutes* to *twenty hours*. These are the extreme limits, and the time will vary according to the degree of heat in the trunk and extremities and the degree of rigidity in the muscles, as well as in the parts of the body affected, the neck and the jaw commonly showing this condition first and the legs the last. It is rare that the warmth of the body is preserved for so long a time as twenty hours; in general it is sensibly cold within ten or twelve, but this estimate will be more or less affected by the condition of the person who makes the observation. During this phase the muscles are susceptible of contraction under the galvanic stimulus and in the early stage under the stimulus of blows. Some warmth is still retained in the internal organs.
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> *Second Period.* In this the body is perfectly cold throughout, and the cadaveric rigidity is well marked. The muscles are no longer capable of contracting under galvanic or mechanical stimuli. In such a case death may have occurred from *ten hours to three days*. It is impossible to give a more definite opinion than this, since there are conditions which may develop rigidity, and under which a body may become cold in ten hours or even in a shorter period. In one instance already related, a body was found *cold* and *rigid nine hours after death*. Again, there are, as we have seen, other conditions which may prevent the cooling of the body, and delay the occurrence or prevent the disappearance of rigidity for so long a period as three or even four days after death. The duration of this stage from ten hours to three days includes the average cases. Here, again, in forming an opinion we are bound to regard the age, the mode of death, and the circumstances in which the body of the deceased may have been exposed.
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> *Third Period.* The body is perfectly cold; the members and trunk are pliant, and are quite free from any remains of cadaveric rigidity. As this condition has ceased spontaneously, the muscles no longer contract under the influence of the galvanic stimulus. In these circumstances it may be assumed that the person has been dead from *three* to *eight days*. In the summer season, however, this period is much shorter; it will more commonly be found to be the condition of bodies which have been dead from one to three days.

Fourth Period. This commences with the access of putrefaction. It is first manifested by a slight bluish green discoloration of the skin of the abdomen, and it gradually spreads throughout the body in the manner elsewhere described. Any doubt concerning the reality of death must cease when the body has reached this stage, at whatever period of time it may manifest itself.

Devergie considers this state to represent the condition of the body from *six* to *twelve days* after death, but the fact is well known that putrefaction may manifest itself on the first or second day, and sometimes as late as the twelfth day, after death. These different periods are somewhat arbitrarily selected, and they can be looked upon only as affording approximate results. During the heat of summer a body may undergo in twenty-four hours all those changes which Devergie assigns to a period of from six to twelve days, while in winter the same changes may not be complete in a shorter period than fifteen days. The ability to give a safe medical opinion must, therefore, depend on an accurate observation of the state of the dead body when first seen, and a proper estimation of all the causes which influence or modify the successive changes. Notwithstanding the apparent want of precision which medical evidence necessarily presents in investigations relative to the period at which a person died, yet the cases already related show that approximate results are often of great value. When founded on a correct knowledge of the state of the body, and when they are corroborated by other circumstances, they are received in law with the greatest benefit to the administration of justice.

Estimation of the time since death by the condition of digestion of the stomach contents has been attempted. In normal cases digestion continues for a time after death, but we have no means of knowing what might have been the state of the gastric juice when the person was alive.

If digestion is complete it is reasonable to assume that a period of two or three hours has elapsed since the meal was eaten, and there is little else to be said. The presence of undigested food in the stomach does not necessarily mean that a meal was taken just before death, though it suggests it.

The Entomology of the Cadaver. There have been many attempts made to form some estimate of the time that a body has been dead by the investigation of the various forms of animal life which are found on it. Megnin undertook a long research into the subject, and came to the conclusion that the onslaught of insects takes place in a definite sequence, and that information of value could be obtained by the investigation of such fauna.

The original thesis should be consulted for details of this investigation.[1] The identification of maggots, pupæ, etc., may have some importance as was shown in the Ruxton case. Assuming that eggs are laid soon after death it is possible by calculating the age of the larvæ to give a reasonably accurate idea of the time that the remains have lain in the place where they are found. While Megnin traversed a very wide field in his researches most value is likely to be obtained from information concerning the common diptera such as the house fly (musca domestica), the blue bottle (calliphora erythrocephala), the green bottle (lucilia cæsar), etc. The technique of the examination and the information which may be derived is described in "Recent Advances in Forensic Medicine," Smith and Glaister, 1939, p. 250.

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[1] "La Faune des Cadavres." Paris, 1894.

CHAPTER VI

APPARENT DEATH: PREMATURE BURIAL

Cases have occurred in which persons suffering from concussion, syncope, catalepsy, hysteria, or apparent lifelessness from exhaustion, either from exposure, or accident, or severe illness, have been pronounced dead by untrained persons merely because there happened to be inanimation, coldness of the surface, and no outward signs of respiration or circulation.

Vagal Inhibition resembling Death. The historic case of Colonel Townshend, who could by a simple effort of the will, so diminish the power of his heart's action that no radial pulse could be felt, and that of the person who could bring about the same result by pressure on a small tumour in the neck may be mentioned in this connection, though they were not cases that in actual fact gave rise to any difficulty.

Fact of Death in Recent Drowning, Hanging and Electrocution. In cases of drowning or hanging it is often difficult to decide whether death has taken place. Coldness and stiffness of the body in the drowned should not prevent the application of means for the restoration of life. One or two hours may elapse before signs of animation appear, and in one instance a drowned person was not restored until the means of resuscitation had been applied for eight hours and a half. There is reason to believe that some persons removed from water in a state of apparent death are consigned to actual death owing to want of timely application of the means, and a want of perseverance in the treatment. The continued coldness of the body and the absence of any evidences of success after a few trials are commonly taken as sure signs that the person is really dead. There appears, however, to be in some cases, if pulled out of the water or suffocating medium, or cut down before stiffness is apparent, a lingering vitality about the body, and some caution is required in pronouncing that a person is really dead, since it at once discourages the efforts of those who are employing means of resuscitation, which should never be relaxed under at least an hour (*vide* under " Drowning "). If, however, the body has been under water for half an hour or longer, or if it has been found hanging or in a suffocating medium and is cold and rigid, there can be no hope of resuscitation.

After electrical shocks the body may present every appearance of death, but many lives have been saved by the perseverance with artificial respiration for long periods.

Apparent Death in New-born Children. In new-born children it is sometimes difficult to determine whether life has or has not ceased. Brachet has succeeded in restoring children in whom the heart's action has been suspended from fifteen to twenty minutes. Respiration and circulation are carried on in such a tranquil manner in an apparently lifeless body that, except by the presence of some degree of warmth and the absence of rigidity, the child might be pronounced dead. Cases are elsewhere recorded in which children have survived birth for six, and even twenty-four hours in this state of passive life. (See "Infanticide," Vol. II.)

PREMATURE BURIAL

There is something terrible in admitting the possibility of premature burial. Numerous cases have occurred where premature burial is alleged to have taken place. *Forty-six* cases are recorded by Fontenelle either of the interment of the living or of apparent death being mistaken for real death. From a careful examination of all these cases, it appears that the greater number of them are derived from sources which render them inadmissible as evidence of what Fontenelle so strenuously endeavoured to prove. He has collected these cases from every source, whether scientific or not, from the time of Plutarch downwards. This very circumstance would make reasonable men distrust those instances of supposed death which are undoubtedly authentic, even if the facts were not explicable on the most common physiological principles.

"Shortly after the great cholera visitation of 1866 Dr. Filippo Pacini, professor of anatomy in Florence, called attention to the subject in a memorable paper. He cited not a few cases in which the patient, certified dead, had come to life on his way to the cemetery, and he started the not unnatural, if horrible, inference that the resuscitation referred to may in several instances have come about within the grave itself. To such an extent has this fear of premature burial been carried in America that an association, called the 'American Society for the Prevention of Premature Burial,' was actually started."

There is no authenticated case on record in England of premature burial that will stand examination, and in the present state of the law as to certification of death there is not the slightest possibility of premature burial.

At present, in England, the *cause* of death must be certified, and a dead body cannot be disposed of except upon the certificate of the registrar (or upon an order of a coroner); but the medical attendant has it in his power to give the certificate without seeing or examining the body of the deceased. Hence arise the possibilities of irregular practices, or even fraud or crime, all of which would be prevented if the medical man were compelled to view the body after death, and to state that he had so viewed it and that the dead body is that of the person whom he has attended during life. If this were the law it would then be very difficult to bury a child as an adult, or a person who had been murdered as one who had died a natural death, or a coffin full of heavy rubbish as the body of a human being.

Where by mistake or by intentional misstatement a medical practitioner is induced to believe that a patient is dead, a death certificate

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[1] *Vide Lancet*, 1900, 2, p. 782.

given by him may be used for criminal purposes, as in the following case:

> "An old man had a daughter who became engaged to a worthless scoundrel. The latter murdered the old man, and sent his *fiancée* to a physician for a bottle of medicine with the tale that the old man had severe bronchitis. Next day the girl called on the doctor and said that the old man had died, and asked for a certificate of death from bronchitis. This the doctor, knowing the old man to have frequently suffered from bronchitis, granted, and only accident prevented the crime from being hushed up."

If the certifier were required to see and to identify the body, the opportunities for the misuse of a certificate would be reduced to a minimum.

Under the Births and Deaths Registration Act, 1926, which came into force in July, 1927, the practitioner is not obliged to view the body before giving a certificate, but he must state in the death certificate whether he saw the body after death and how long before death he last saw the deceased alive. Registrars have been instructed, it is believed, to refer to the Coroner cases in which a certificate has been given by a medical practitioner who has not seen the body after death or who has not been in attendance within 14 days before death.

Cases of trance or of unnatural sleep or of apparent death from drowning, etc., can always be differentiated from death either by some of the simple tests mentioned in the preceding pages or by the application of electrical or other stimuli to the muscles.

CHAPTER VII

GENERAL INFERENCES TO BE DRAWN FROM THE EXAMINATION OF A DEAD BODY APART FROM THE CAUSE OF DEATH

It frequently happens that the exact cause of death is of less importance in helping the ends of justice than the deductions which can be drawn by a skilled medical jurist from the circumstances surrounding an unknown dead body. Having reviewed the signs of death, with the changes resulting in the body from death, we must now go back to consider some of the problems which may be solved relative to the body, by general observation of the changes we have described.

Deductions as to bloodstains or wounds and such special features will be considered under those headings. Here we shall proceed in the following order :

Deductions to be made from the position of the body before decomposition : (*a*) from its posture ; (*b*) from hypostases and blood clots.

Inferences as to the time of death of a person whose body has not yet begun to decompose.

Inferences as to the time of death of a person whose body has begun to decompose.

Criminal cases in which these inferences were of value.

Decomposition contrasted with the results of disease, poison, or violence.

Inferences from putrefaction as to how long a body has lain in the water.

Inferences from the Position of a Dead Body as to Interference at or after Death

(*a*) **From its Posture.** The postures in which the bodies of persons found dead from any cause are discovered may, in numerous cases, be brought forward to support a charge of murder, or, at least, of criminal interference ; but great care is always required in the application of medical principles to the elucidation of these cases, as well as a good general acquaintance with the various phenomena immediately preceding and following death.

As the body becomes rigid in the position in which it happens to be on cooling and assumes exactly the attitude of the person at the time of death careful observation may, in some instances, show whether, in a case of violent death, it was or was not interfered with *before* rigidity took place. A question of this kind arose in the following case :—

The deceased was found lying dead in the room where the murder had been perpetrated ; there were marks of blood in various places, and the body had evidently been removed from the spot where it had fallen ; it had been laid out. The clothes had been tucked round it, and a piece of black cloth had been placed over the face.

A question arose whether the body had been thus removed before or after rigidity occurred. As it was found evenly laid out, the probability was that it had been removed while the limbs were pliant ; and they had then become rigid in this position. If a body is removed during the state of rigidity, then, in some instances, the fact that it was so removed after rigidity had set in may be indicated by the position of the still rigid limbs not being adapted to the surface on which the body is found lying. It has been already stated that the first effect of death, in the absence of cadaveric spasm, is relaxation of the muscles ; the body then disposes itself according to the surface on which it happens to be lying ; the arms or legs may be more or less fixed or contorted, or become rigid in the position which they assumed by gravitation at the time of death. The lower jaw, if left to itself, drops and becomes rigid in this position. When a body is found rigid, with the members evenly extended and the jaws closed, that is *cæteris paribus*, strongly indicative of interference while there was warmth and pliancy in the limbs. When, on the other hand, the body is found rigid and doubled up, with the limbs more or less twisted, lying on an even surface like a bed, the probability is, according to circumstances, that the body had been moved from the spot in which the person had died, and in which rigidity had supervened. In suicidal hanging, the body, and especially the extremities, are now and then found twisted in a singular manner around articles of furniture. In such cases, the general muscular convulsion, at the moment of death, will physiologically explain what to uninformed persons may appear physically incompatible with the deceased having destroyed himself.

The following case will serve as an illustration of the occasional importance of these inquiries :—

Robert Reid was tried before the High Court of Justiciary at Edinburgh for the murder of his wife. Among the medical circumstances which gave rise to conflicting opinions was one which referred to the posture in which the body of the deceased was found. It was thus described by a witness : " She " (deceased) " was sitting on the floor by the side of the bed, nearly naked, with a portion of the bedclothes wrapped around the lower part of her body, the head erect, but inclined a little backwards and to one side, the face being towards the bed. The left arm hung down by her side, with the back of the hand on the ground, the right arm resting by the elbow on the bed, and maintained in the upright position without any further support, as if she had been in the act of putting it to her face. The legs were crossed under the trunk, the left being less protruded than the right."

This extraordinary posture was assumed by all who saw it and by the medical witnesses for the prosecution to be such that the deceased could not have assumed it herself in the act of dying ; and this was rendered still less probable when it was considered that the cervical vertebræ were fractured, and one of them was displaced, so that she had probably died a violent and very sudden death. The attitude appeared to be also quite irreconcilable with the possibility of death from accident or suicide. The chief question seems to have been whether, admitting that the prisoner had actually placed his wife in this posture, the maintenance of it was to be ascribed to a convulsive spasm, simultaneously occurring with death, or to the supervention of ordinary cadaveric rigidity. If the posture were admitted to have been due to cadaveric rigidity naturally supervening, then the inference would be that the deceased had been dead at least some hours. The prisoner was proved to have been at home from nine until half-past nine; the deceased's body was discovered at two, and as the prisoner had not been at the house between half-past nine and two, so it followed that, supposing him to have been guilty, he must have committed the murder during the half-hour that he was at home. Hence cadaveric rigidity must have come on in four hours and a half after death. On the other hand, it was urged that the attitude of the body and the singular perpendicular position of the right arm were due to a spasmodic contraction of the muscle in a fit, at the moment of death, persisting under the form of cadaveric spasm. The non-medical witnesses stated that the body of deceased when found was perfectly flexible, and the arms and legs so pliant that they could be easily stretched down; indeed, the whole body was so yielding as to admit of its being directly laid out at length on the floor. The body was partially warm when first found, but, as it has been already observed, this is quite compatible with the occurrence of rigidity. Certainly, however, when a body is warm, and the members are easily moved from their position, the presumption is rather in favour of the fixed posture being due to muscular spasm than to cadaveric rigidity.

The witnesses for the defence considered that the posture of the deceased was owing to simple rigidity. Fletcher attempted to explain the facts by supposing that the deceased had probably fallen in a fit while getting out of bed during the absence of the prisoner, admitting that the prisoner might on his entrance, at about nine o'clock, have attempted to raise the body, and thus have given the erect position to the trunk, while the perpendicular position of the arm was entirely due to spasm. It was urged that the woman had been previously subject to slight paralysis and convulsive fits, and that the occurrence of a fit, in the circumstances, was not unlikely. The position was not such as we might suppose a body to assume when a person has died under a cataleptic seizure. On the other side it was considered to be improbable that the prisoner could have placed the deceased in the attitude in which she was discovered, admitting her to have died in any other posture, since at the time he did it the body must have been either rigid or not. If it were rigid, he could not easily have bent the members from the position which they had already assumed; and if it were not rigid, he must have used artificial means to keep the members and trunk in the extraordinary position in which they were found; for it was not likely that he would have purposely held her head and arm in such a singular attitude until her body had become fixed. Indeed, in order to accomplish this, he must have waited until it had become cold, whereas it is stated to have been found with some warmth and pliancy about it. Besides, it would be impossible to assign any reason for so doing, since he would be ignorant of the medical difficulty connected with it.

The prisoner was discharged on a verdict of not proven, because it was not satisfactorily made out that he had really caused his wife's death. The state in which the deceased was found created a presumption that she had died from natural causes not long before the discovery of her body, therefore at some time between half-past nine and two, and while the prisoner was absent from the house. The account of this case, as given by Fletcher, was most favourable for the prisoner; he suggested many ingenious explanations for circumstances which were certainly very strong against him. The verdict of not proven sufficiently attests the opinion of the jury; and had the medical evidence respecting the cause of death from violence been a little clearer, there is hardly a doubt that the prisoner would have been convicted.

Whether this was a case of death from natural causes, or, as alleged, from an injury to the spinal marrow, we must regard the attitude in which the body was discovered as very unusual. There were difficulties in the way of an explanation, whether we suppose the prisoner to have interfered or not with the position of his wife's body. Had a proper examination been made by medical men when it was first discovered by the neighbours, some of these difficulties would probably not have existed. With a fracture of the odontoid process and a dislocation of the first and second vertebræ, it is not likely (unless the body had been supported mechanically by the clothes, which, it is said, presented the appearance of having been dragged off the bed with it) that a person so injured would die in the attitude in which the deceased was discovered, or that she could have had the power to assume it spontaneously after such a severe injury to the spinal column. The probability is that the body would have been found lying on the floor.

While rigidity, in peculiar positions, may sometimes indicate murder, or some form of violent death, by fixing the body in a position which it could not naturally have assumed, and which cannot be easily altered during the rigid state, we must beware that we do not give an undue importance to this sign of death as a proof of violent usage. This caution is especially required in the cases of drunkards, for the body of a person who dies in a fit of drunkenness may be found contorted and arranged in a way which might be apparently incompatible with either accident or suicide

(*b*) **From Hypostases.** We have already noted that hypostases form in the most dependent parts of a body. and also that they may be disturbed by the gases of putrefaction, and that they may be observed internally as well as externally. Hence, putting these facts together, it is possible by noting the position of the hypostases and also the position of the dark part of a large clot of blood—in heart or aorta, for instance—to tell whether a body lay on its face, or back, or side after death, and also whether it has been moved since death.

It will probably, but seldom, happen that such moving of a body is of importance, for bodies are almost invariably moved to a mortuary of some sort before inspection, but in the cases of bodies found under suspicious circumstances notes should be made of these points, for it frequently happens that little-noticed points become of great importance at a later stage.

In this connection it is not out of place to call attention to the differences between **ante- and post-mortem clots of blood,** for the latter may give very distinct clues to the position a body lay in after death, while the former give no indication.

In the heart and great vessels we frequently find large masses of clot. If these be of *post-mortem* origin they will show (*a*) that the red corpuscles, being of a greater specific gravity than the serum or the white corpuscles, have sunk to the lowest part, and (*b*) that the clot as a whole is in consequence divided into a lower coloured and an upper colourless or white-coloured part with a buff-coloured layer between them. The differences between *ante-* and *post-mortem* clot may be thus tabulated:

Ante-mortem	*Post-mortem*
1. More or less uniformly coloured of a greyish red, certainly with no *marked* contrasts.	1. Colour as above, two distinct layers contrasted.
2. Firmer in consistency.	2. Softer.
3. Shreddy, and often can be stripped or peeled off in layers.	3. Each part of the clot is homogeneous in construction, like jelly, and it cannot be thus stripped into layers.
4. The surface of the blood-vessel appears roughened when the clot is removed ; the clot adheres pretty firmly.	4. Surface of blood-vessel quite smooth and healthy-looking after clot is removed.
(The interlacing of a clot amongst the chordæ tendineæ of the heart and the consequent difficulty in its removal must not be mistaken for the above.)	

Inexperienced pathologists are inclined to attribute death to a pulmonary embolism when they find a large clot in the pulmonary artery. Any clot found there should be carefully and gently pulled out, when, if it were *post-mortem*, it will pull out easily and be found to terminate in a sort of horse tail of small clots (casts of the branches of the artery). If there be an *ante-mortem* embolus, the clot will either (*a*) not pull out so easily, or (*b*) if it does pull out easily, there will be an obvious break in the horse tail, a fair-sized piece being missing.

Inferences as to the Time of Death from the Condition of the Body before Putrefaction has set in

Inferences from Warmth and Condition of Muscles. The changes which take place in a dead body before the commencement of putrefaction, if accurately observed, may sometimes enable a medical witness to form an opinion of the time at which the deceased died. The dead body of a person may be found in a house with marks of murderous violence upon it ; the crime may have been so recently perpetrated that the body still retains the warmth and pliancy observed in the recently dead, or it may be found in a cold and rigid state. A person charged with the murder may be able to prove that he had not been in the house for many hours or days, or evidence may be adduced to show that he was there at a time which would correspond to the condition of the body when found. In cases of sudden death from violence or suspected poisoning, a medical man, by observing the state of the body, may frequently form a judgment of the time at which death occurred, and therefore of the period at which poison was taken by deceased, or violence was inflicted on the body.

In the following case of murder and suicide, the murderer was clearly pointed out by the difference in the condition of the two dead bodies when they were first discovered :—

> A man and his wife were found dead in bed, and their bodies were covered with blood from wounds inflicted on both. In the case of the woman there was a deep incision in the throat, besides a wound under the chin, and another on the side of the head. The man's throat was also severely cut ; the razor with which the wounds had been inflicted was found on the bed, within a short distance of his right hand, as if, in the last act of life, he had endeavoured to throw the weapon from him, but had failed in the attempt. The body of the woman was cold and rigid ; that of the man was warm.

The nature and direction of the wounds, and the marks of violence on the woman's person, were such as to render it probable that she had not committed suicide, and the condition of her body showed that she had been dead many hours. On the other hand, the wound in the man's throat was such that he could not have long survived its infliction ; and as his body when found was warm and pliant, it was a reasonable inference that the wife had died first, and from wounds inflicted by her husband, as no other person had access to the house. If the body of the wife had been found warm, while that of her husband was cold and rigid, the inference of his having been her murderer (the wound in her throat being of a nature to produce instant or very speedy death) could not have been sustained. In forming a judgment of priority of death in such cases, the sufficiency of the wound to produce instant or rapid death must always be taken into consideration. A person may inflict on another a slight wound which may prove fatal by hæmorrhage only after some hours, while he may afterwards inflict upon himself a wound which would instantly destroy life. In such a case the body of a murderer would be found cold, while that of the victim, by reason of the death being more recent, would be warm. In the case of a woman who was found dead in her apartment with her throat cut it was ascertained that, when first discovered, the body was so warm as to render it highly probable that the crime must have been committed within an hour. This observation tended to prove the innocence of a person who was suspected of the murder because it was known that he had been absent from the house for at least five hours.

In the following case, which is a type of many, the theory of suicide was sustained, and that of homicide completely rebutted, by a medical inference from the condition of the body :—

> In 1830 the Prince de Condé, or Duke of Bourbon, was found dead in his bedroom, in the Château of St. Leu. When discovered, at eight o'clock in the morning, the deceased was found, partly undressed, hanging by his cravat to one of the window-shutters. The body was cold, and the lower extremities were quite rigid.
>
> The medical examiners inferred that the deceased must have died very soon after he had retired to his bedroom on the previous night. As this was proved to have been 10 p.m., it followed that only ten hours had elapsed—a short time for cooling and rigidity to have taken place. It was thus rendered probable that the hanging took place soon after the deceased had entered his bedroom. It was alleged that the Duke had been murdered, and his body afterwards suspended by his murderers to create the suspicion of suicide. The condition of the body, among other circumstances, was, however, adverse to his presumption. From 10 to 12 p.m. it was proved that there were numerous attendants moving about near to the Duke's apartments. These persons must have heard any unusual noise which the Duke would probably have made in resisting his assailants. But no noise was heard

in the apartments at that or any other time, and the presumption of this being an act of homicide was therefore strongly rebutted. Had the body been found warm and pliant, and the joints flexible, the inference would have been that the deceased had died more recently, and therefore at a time when murder might have been perpetrated without attracting the observation of his attendants. As it was, the coldness and rigidity of the body justified the medical opinion expressed, and tended to prove that this was really an act of suicide.

Criminals sometimes unwittingly furnish important evidence in reference to the condition of the dead body.

A schoolmaster named Hopley was convicted of flogging a pupil to death. There was reason to believe that the boy had died during the actual beating. The accused stated before the coroner that he went into the boy's bedroom about six o'clock in the morning, and found the boy dead, his body cold, and his arms stiffening. He suggested that he might have died from natural causes. It was proved that the prisoner was heard in the act of beating the boy up to half-past eleven on the previous night; and as the body was cold when found, and rigidity was commencing, there was a strong probability that the boy must have been dead at least six or seven hours, and, therefore, at a time when the prisoner was last known to have been with him. The body was well developed and covered with bedclothes.

In *R.* v. *Doidge*[1] medical evidence derived from the state of the dead body when found tended materially to corroborate the circumstantial evidence against the accused. The deceased was last seen alive at 10.30 p.m. He was found about 9.30 the next morning dead in his house; he was lying on his face with his clothes on, one arm under the chest, and the other by his side. He had received on the back of the head some severe blows, which must have proved speedily fatal. The body when found was quite cold, and the limbs were rigid. The medical evidence was that the deceased, in these circumstances, had been dead from eight to ten hours.

There was no doubt that this was an act of murder, and that the deceased has been killed while taking off his boots before going to bed. The prisoner was connected with the act by a chain of circumstances. He was seen drinking and conversing on friendly terms with the deceased at a beershop the evening before. The prisoner left the shop at a quarter-past ten, and the deceased at half-past ten. They both lived near to the shop and to each other. A neighbour heard at twelve o'clock the voices of two persons in conversation in the deceased's kitchen. One of them he recognised as that of the deceased, and the other as the voice of the prisoner, with which he was well acquainted. This witness heard the voices for some minutes, then went to bed. He was soon afterwards suddenly awakened by a noise like that of a heavy fall proceeding from the deceased's kitchen, in which the dead body was afterwards found. His evidence was corroborated by that of his wife; and hence it is clear that the deceased was alive for some time after twelve o'clock that night. It was further proved that, contrary to his usual practice, the prisoner did not return home to his lodging until one o'clock in the morning; and then, in order to account for his return at so late an hour, he made a statement which was proved to be untrue. The coldness and rigidity of the body, therefore, when discovered at 9.30 a.m., considering the season of the year and the circumstances that the deceased was in his clothes, were facts in themselves quite consistent with the occurrence of death soon after twelve o'clock at night, or about the time when a heavy fall was heard by the neighbour. Other circumstances, which were proved, left no reasonable doubt of the prisoner's guilt, and he was convicted.

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[1] Bodmin Assizes, 1862.

Perhaps no case has brought the importance of questions of this nature so prominently before the public as that of *R.* v. *Gardner.*[1]

The prisoner lived with his wife and another woman. The wife was found dead in her bedroom, with wounds in her throat, at 8 a.m. The nature and direction of the wounds, the position of the body and the weapon, as well as other circumstances, conclusively proved that this was an act of murder. The facts, as they bear upon the question which we are now considering, are very simple. Sequeira saw the body of the deceased, a healthy, well-developed woman, *æt.* 37, at 8 a.m. Her body was found lying on a wooden floor, covered with a flannel petticoat and a chemise. The upper limbs were cold and rigid ; the face, shoulders, and chest were cold ; the neck was so rigidly fixed with the trunk that the entire body was lifted up with it when the head and neck were raised ; the thighs and legs were quite cold, but there was no rigidity in these parts. The only warmth found about the body was in the lower part of the abdomen.

The opinion on the time of death given by Sequeira before its exact bearing on the guilt of the prisoner could have been known was that the deceased had been dead *above four hours*, certainly more than three, and that she could not have been dead so short a time as two or three hours when he first saw the body. This opinion was corroborated at the trial by another medical witness, Comley, who affirmed that, considering the general coldness of the body, the deceased, when seen at eight o'clock, had been dead above rather than under four hours. There was a severe wound on the throat, involving the superior thyroid artery and other vessels. From this about two pints of blood had flowed on each side of the neck on the floor. The larynx had been laid open between the thyroid and cricoid cartilages. Blood had flowed into the windpipe through this aperture, and had thus, by obstructing respiration, produced death by asphyxia.

Without going into all those circumstances which tended to fix this crime beyond any reasonable doubt upon the man Gardner, it may be sufficient to state that the defence turned principally upon the condition of the dead body when found. It was proved that from 4 to 8 a.m.—*i.e.*, for about four hours—the prisoner was absent from home, following his usual occupation as a chimney sweep. It was contended by his counsel that within this short period the body might have become cold and rigid as it was found and, therefore, that the murder had been perpetrated by someone during his absence. The facts proved at the trial were, however, considered by the jury to be quite inconsistent with the innocence of the prisoner, and he was convicted of the crime.

The opinions given by the medical witnesses at the trial, regarding the inference derivable from the state of the dead body, were reasonable, and in accordance with scientific observations. In assigning *four hours* for the almost entire cooling and commencement of rigidity of the dead body of a woman suddenly dying in the prime of life, the body not being exposed to any specially cooling influences, it is obvious that they could not be charged with overstating, but rather definitely with understating, the period of time required. Considering that death had taken place by asphyxia, if they had assigned six or eight hours, it would have been only consistent with ordinary experience. It is, indeed, more probable that this time had actually elapsed, and that the woman had died in from two to four hours before the male prisoner had left the house, than that her body, in the circumstances proved had become cold and partially rigid in less than four hours. In one hundred cases observed by Wilks and Taylor, there was not an instance in which such rapid cooling and access of rigidity occurred. In Gardner's case, it was supposed that the loss of blood would account for this state of the body at so early a period after death; but, in the first place, the deceased did not die from hæmorrhage, but from suffocation; and, secondly, the loss of twice as much blood in hæmorrhage proving suddenly fatal led to no acceleration of cooling or rigidity in the dead body.

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[1] C.C.C., Oct., 1862.

H.M. Advocate v. *McLachlan* furnishes an additional proof of the correctness of these views in reference to the bodies of persons found dead from loss of blood.

> Macleod saw the body of the deceased on the night of July 7th. The mean temperature of the air on that day had been 51° F. "*Rigor mortis* was present in all the articulations, but it was then departing. The body was perfectly cold, even on the abdomen. On the following day, at 10 a.m., the rigidity had gone from all the joints excepting the knees and ankles. There were no signs of decomposition, and the temperature was very cool, unusually so for the season. The room in which the body had laid was well ventilated, but without a draught. It was below the level of the street, and the body lay on a wooden floor, and was partially covered. Death had resulted from violence; it had been attended with profuse hæmorrhage, and the victim was free from disease, in the prime of life (*æt.* 35), and of a thin, wiry frame."

Macleod considering that *rigor mortis* is found in from ten hours to three days after death, and that in sudden death from violence it is only slowly developed, thought it most probable that forty-eight hours after death (at the longest) would represent the time when rigidity would appear. "Relying on the same considerations as influenced the opinion formed of the time of the establishment of the stiffening, it was thought that about thirty hours would probably represent the period of the continuance of the rigidity; and by summing these periods—forty-eight and thirty—together the conclusion was arrived at that about *three days* had probably intervened since death; and it will be remembered that it was afterwards proved as nearly as could be, that this was the time which had passed between death and the examination of the body. In the case of McPherson there was no appearance of decomposition. The cold atmosphere, the thin body, drained of its blood, the middle age, and thin covering, all opposed its development."[1] This medical opinion, formed from the state of the body, tended to confirm that part of the prisoner's story which related to the time of death.

On these occasions, unless we have a due regard to all the circumstances of a case, grave errors may be committed. A period of death may be assigned which is inconsistent with the proved facts, and thus give impunity to murders. Ollivier and Devergie were once required to examine a medical report by two physicians in which they stated that they had found the deceased, a woman, aged sixty, dead in her apartment from strangulation. When the body was found it was lying on the floor, clothed in her usual dress of cotton and flannel, in a state of cadaveric rigidity, with general lividity of the surface of the skin. It was cold, with the exception of a slight warmth, which remained in the abdominal viscera when the inspection was made. From these data the inspectors came to the conclusion that the deceased had not been dead more than from fifteen to twenty hours before the time at which they saw the body. This would have fixed the date of the murderous assault at 1 p.m. on March 6th, whereas the general evidence tended to show that the crime must have been committed on the night of March 4th or 5th.

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[1] "Account of the Medical Evidence at the Trial of Jessie McLachlan," by G. H. Macleod, M.D., Glasgow, 1862, p. 8.

Considering that the deceased had died from asphyxia, in which case warmth is usually retained, that her body was well clothed, and yet rigid and cold, with the exception of a doubtful trace of warmth in the abdominal viscera, Ollivier and Devergie came to the conclusion that there was no medical ground on which such a restriction of the period of death was justifiable. They contended that cadaveric rigidity, when once established, might remain two, three, or four days, according to the season of the year and other circumstances; and that when it existed there was no rule by which it could be determined whether the body had been in this state for two or three hours or two or three days. The retention of warmth by the abdominal viscera may be met with after fifteen to twenty hours in a much more marked degree than in this case. In one case, already referred to, the temperature of the viscera of the abdomen, more than seventeen hours after death, was found to be 76° F., although no care had been taken to preserve the warmth of the body.

Inferences as to Time of Death from Digestion of Food. The state of digestion of the contents of the stomach is often used as a means of fixing the hour of death. Most elaborate tables have been prepared of the time taken by the stomach to digest certain articles of diet, of which the following may be taken as an example :—

Article.	Time for digestion.		Article.	Time for digestion.	
	hr.	min.		hr.	min.
Rice	1	0	Eggs, soft boiled	3	0
Apples, cooked	1	30	Beef	3	0
Venison	1	30	Carrots, boiled	3	15
Sago	1	45	Potatoes ,,	3	30
Bread	2	0	Turnips ,,	3	30
Milk	2	0	Butter and cheese	3	30
Cabbage	2	0	Oysters, stewed	3	30
Oysters, raw	2	3	Eggs, hard boiled	3	30
Eggs, raw	2	3	Pork, boiled	3	30
Potatoes, roast	2	30	Fowls	4	0
Parsnips, cooked	2	30	Wild fowl	4	30
Turkey	2	30	Beef, salt	5	30
Goose	2	30	Pork, roast	5	30
Custard, baked	2	45	Veal, ,,	5	30
Mutton	3	0			

The table must not be taken as of mathematical certainty, but represents fair averages. The rate of digestion varies in different persons and according to the state of the gastric mucosa. Digestion takes longer in cases of coma and insensibility. Death does not at once cause the process of digestion to cease. The stomach can even digest itself after death. Therefore, evidence from this source must be treated with great reserve.

Inferences from Observation on a Body after Putrefaction has set in

Orfila, after having devoted many years to the investigation of this subject, and after the comparative examination of some hundreds of exhumed bodies of all ages, and of both sexes, came to the conclusion that it was beyond the reach of science to determine with accuracy the period of death from the progress of putrefaction. Bodies which had been buried for an equal length of time in the same soil under apparently similar conditions frequently presented such differences as to baffle all attempts at generalisation. This question becomes even more difficult when the body is submitted to examination, and none of the conditions under which the person has died, or to which the body has been exposed after death, are known. It will be perceived from what has been already stated that the circumstances which affect the rate and progress of putrefaction are numerous, and of a variable character. If we can obtain no history of the case, a medical opinion can be little more than a conjecture; if, however, we are informed of the atmospheric and other conditions to which a dead body has been exposed, it may then be in our power to arrive at a probable, if not a definite conclusion. In the description of the modifying conditions above given, the practitioner will find some points which may render him assistance, or, at any rate, enable him to avoid some of the serious errors which have been made by medical witnesses in reference to this subject. It has been elsewhere stated that putrefaction does not commonly commence until about the third day after death; but there are many instances known of its commencing almost immediately after death and proceeding with great rapidity, while in other cases more than twenty days have passed without any naked eye indication of its presence.

Cases of Unusually Rapid Decomposition. As has been described above the onset of putrefaction depends on the invasion of the tissues by bacteria and their continued growth. Anything which increases the rates of invasion, such as damage to the surface or infection of the viscera or blood by putrefactive organisms, will necessarily increase the speed of putrefaction. Moisture of the tissues and increased temperature of the atmosphere are equally important factors. In certain cases there may therefore be a tremendous acceleration in the rate of putrefaction. Normally, in this country, little sign of decay can be seen for two or three days, but every pathologist has seen cases of advanced putrefaction in a day or two when the person has died of septicæmia in hot weather.

Sometimes decomposition is so rapid that in a few hours the features of a person are unrecognisable. A man, *æt.* 26, died in November, of typhoid fever and perforation of the ileum. The weather was cold and moist. When the examination was about to be made sixteen hours after death, the body was wholly unlike that of the man when alive. There was no rigidity; the whole body was bloated; the cellular tissue was greatly distended, so that when the skin was pierced the gas which escaped was easily ignited. The colour of the surface was of a reddish hue. The internal organs were also much decomposed, of a dark colour, soft, and emitted a very fœtid odour. The liver was full of gas. The patient was a temperate man, and had resided in the country.

A plethoric man met with an accident in November, and died at 10 o'clock p.m. An inquest was held on the body the next morning at 11 a.m. Although only thirteen hours had elapsed since death, the body was highly putrefied, presenting a bloated appearance, and the face was so swollen and discoloured that the features could not be recognised. The gases which escaped were so offensive that the jury could not approach the body. No inspection was made.

A man, *æt.* 35, shot himself with a pistol, producing fracture of the skull and injury to the brain, from which he died in six days. On December 13th, the atmosphere being cold but moist, the body was brought into a room for examination, thirteen hours after death. The rigidity was imperfect, but still present to a slight degree; the body was warm; when opened, it showed that a remarkable change had taken place internally, so that it was even suggested that decomposition had commenced before death. The brain was soft and decomposed; the lungs showed recent inflammation, and the air-tubes were deeply stained by imbibition of hæmoglobin; the interior of the heart and arteries was of a dark purple colour, and the clots in the heart were mixed with gas; the peritoneum was discoloured; the liver presented a remarkable appearance, it was full of gas, and thus resembled a mass of fermenting dough; on the surface were bubbles of gas ready to burst; this organ contained two small pyæmic abscesses. The spleen was of a greenish colour; the kidneys closely resembled the liver, being, like it, distended from decomposition, and containing gas bubbles throughout their substance.

In another case, a man, *æt.* 50, died from an accident in December. He lost much venous blood, and, without showing any sign of rallying from the accident, died on the fourth day after his admission. The man died at 6 p.m., and in an hour or two his body was carried to the deadhouse. The weather was frosty, and there was a hard frost during the night on which the body lay in the deadhouse. On the following day (only twenty hours after death) putrefaction had advanced to such a degree that deceased could scarcely be recognised. The skin was throughout distended by the gases of putrefaction. All the viscera were decomposed, the liver contained putrescent gases, and even the coats of the gall-bladder were distended with them. This was a case of rapid death, probably from blood-poisoning.

In these cases the effects of the bacillus aerogenes capsulatus are clearly seen, and such cases could be multiplied indefinitely. The condition of these bodies in reference to the process of putrefaction is such as Devergie assigns to dead bodies at a period of six to twelve days after death, on the assumption that they have been freely exposed to the air at a mean temperature. Had the body of this person been found in a house in these circumstances, and had the history of the case been entirely unknown, a medical man, asked to assign a period of death from common experience in such matters, might have declared it to be impossible that the deceased could have been living within twenty-four hours previous to the discovery. Suspicion might thus be removed from persons really guilty of murder, because it might be proved that they had not been in or near the house until within a day of the discovery of the body. On the other hand, an innocent person who had been seen in company with the deceased five or six days previously, might be unjustly charged with having been accessory to his death. This, with other instances of a similar kind, shows that unusual caution is required in expressing a medical opinion on the time at which death took place in bodies which are found much decomposed

Criminal Cases Illustrative of the Difficulties of deciding the Exact Time of Death

There is great difficulty in the practical application of the principles laid down above to the determination of the probable period of death in reference to the body of a person found dead. Medical opinions are frequently required in cases of alleged child murder on the probable date of death of a child whose body has been found in a putrefied state. With a due regard to the conditions under which the body has been placed, a medical witness may occasionally be able to say whether its state was such as to be consistent or inconsistent with the delivery of an accused woman at a particular period of time.

Greater difficulties occur on charges of murder in reference to the bodies of adults found dead in suspicious circumstances. The connection of an accused person with the act may occasionally turn upon a medical opinion respecting the state of the dead body.

A man named Desha was charged with the murder of Francis Baker. The deceased was last seen with the prisoner on November 2nd. Six days afterwards the body of the deceased was found in a sheltered hollow, with the throat cut, several wounds on the head, and a wound on the chest. There was no doubt from the nature of the wounds that the deceased had been murdered, and that he must have died soon after their infliction. The defence of the prisoner rested to a great extent on the condition of the body when found, the principal question being whether the state of the body was consistent with the suggestion of violent death caused *six days* previously. When discovered it had undergone so little change that it was considered the deceased must have been alive some days after the prisoner had been last seen in his company. The body when first found is described as having been a little stiff; but after being carried some distance it became pliant. There was no appearance of putrefaction about it, either by the smell or by any change of colour in the skin In two days after its discovery, during which period it had been placed in a room in which there was a fire, putrefaction set in, and the abdomen and face became much swollen and decomposed. At this time—*i.e.*, the eighth day after the deceased had been seen alive—much blood issued from the wounds. According to one medical witness, the wounds at this date appeared fresh; according to another, they did not. There was some conflicting evidence, lay and professional, on the question whether putrefaction could be so completely suspended during eight days as it had been in this instance. The counsel for the prisoner dwelt upon the absence of the process as a proof that death must have been recent. and therefore that the prisoner could have had no share in it. The judge also inclined to this view. In addressing the jury he said, "It is difficult to suppose that a body at this or any season of the year could have remained that long without exhibiting some symptoms of putrescence." Another singular point raised in the prisoner's favour (*vide* "Hair in Identity"), was that the beard had grown after the discovery of the body—it was quite short when it was first seen, and had the appearance of having been recently shaven; but in the interval of three days after its discovery it had become a little longer. Counsel contended that the beard will grow after death; and as, when the body was found, the chin was cleanly shaven, this pointed to recent, and not to remote, death, as the beard would have already become elongated when the body was found had the deceased been dead six days. The medical witnesses, in reference to this theory, stated that the appearance of growth after death was to be ascribed to a shrinking of the skin. The jury returned a verdict of guilty. The prisoner subsequently committed suicide, and, while dying of his wounds, protested his innocence of the crime.

This case does not appear to present much difficulty. The fact that the body of the deceased remained six days in a sheltered spot during the month of November, without undergoing any of the usual changes from putrefaction is consistent with death six days previously. When found the body had reached the third stage described by Devergie: it was cold and pliant, or readily became so; it had passed through the stage of cadaveric rigidity. The fact that putrefaction came on in two or three days after its discovery is fully explained by the high temperature to which the body was then exposed. The state of the beard did not justify the inference that death had been more recent. Neither the age nor the condition of the deceased's body is stated, but it is clear that he died suddenly from loss of blood as well as other injuries. It may be inferred, therefore, that his muscular system was endowed with the ordinary amount of irritability.

Other cases have occurred in which the rapid rate of putrefaction following sudden death has resulted in the bringing of a charge of murder.

where the accused has been acquitted on the ground that the changes produced by putrefaction had been mistaken for the effects of violence.

R. v. *Byrne.* The prisoner and the deceased were in the habit of drinking to excess. On this occasion they had retired to their bedroom, and about four days after the deceased had been last seen alive and eight days after they had been in the room the body of the husband was found dead on the bed, while the wife was in the room. She professed not to know that her husband was dead, and sent for a medical man. From his evidence it appeared that when he first saw the body on the evening of July 9th it was so much decomposed that he was led to believed the deceased had been dead at least four or five days. The face and neck were black, and decomposition had gone on to such a degree in these parts as to obliterate, it was believed, any marks of violence that might have been there at the time of death. The right eye was protruded, the tongue projected between the teeth to about half an inch, the ears were black, the lips swollen, and the fingers contracted. There was a frothy liquid issuing from the mouth and nostrils in bubbles, and living maggots were seen in these parts. The whole body was greatly swollen, discoloured, and passing rapidly into a state of decomposition. When first seen the deceased was lying on his face. An inspection made the next day revealed the fact that putrefaction had taken place in all parts, but the head and neck were most decomposed. The black colour of the skin appeared to decline as it got down to the lower part of the neck. Internally the heart was empty, and the vessels of the brain were perfectly empty ; the blood was fluid.

There were two medical questions in this case on which the guilt of the prisoner rested : (1) When did the deceased die ? and (2) Was death to be ascribed to violent or natural causes ? On July 1st, eight days before his body was found, the deceased had retired to his bedroom with his wife. On the 3rd the voice of the deceased was heard as if he and his wife were quarrelling. On the 4th they were not seen. On the 5th a manservant deposed that he was called upstairs by the deceased, who spoke to him, and gave him half a crown to fetch whisky. He then heard the deceased's voice, and saw his bare arm through the partly opened door ; but, from the position in which he was placed, he could not see the whole of the deceased's body. After this date the deceased was neither seen nor heard. He was found dead on the evening of July 9th, his body being then in the highly decomposed state above described. On July 6th the prisoner left the bedroom for a short time, and closed the door. On the 7th and 8th she was seen at the door of the bedroom by a manservant, and on the latter day by her maidservant, and she was then quite sober, and spoke to them as usual. On the 9th, at 10 a.m., she ordered the servant to bring up *two* cups of tea. Between 6 and 8 p.m. on that day she suddenly called to one of her sons to turn the deceased on his back. On entering the bedroom he found the deceased dead, and the body as above described. As the prisoner had been in the bedroom alone with the deceased, either living or dead, from July 5th, when he was last seen, until the 9th, she must, it was alleged, have been cognisant of his death, if it had not been directly caused by some act on her part. The prisoner made two statements : first, that she slept in the bed on the 7th and 8th, and that the deceased died on the 8th. She subsequently stated that he died on the 9th, the day on which the body was discovered.

From the state of decomposition of the body, two of the medical witnesses for the prosecution assigned a period of at least four or five days during which deceased must have been dead. Two declined to give an opinion as to the number of days, but Geoghegan stated his belief that such changes might take place in from twenty-eight to thirty hours. A medical witness called for the defence deposed that he had seen a body as much decomposed twenty-four hours after death. On referring to cases elsewhere related it will be perceived that the shorter period assigned by these two witnesses, one for the prosecution and the other for the defence, is quite within the limits assigned by experience, although cases of such rapid putrefaction are not common. In this case, however, it must be remembered that the dead body was shut up in a close room at the hottest period of the year, and the circumstances were therefore most favourable to the process. Although this might have been an exceptional instance of rapid decomposition, the changes described by the witnesses might have occurred within twenty hours of the time at which the body was discovered, thus carrying the death to the night of the 8th, at the time when prisoner was, according to her statement, in bed with the deceased.

The other question, as to the cause of death, gave rise to a conflict of opinion. On the one hand, it was alleged that the appearances in the body—*i.e.*, the black and decomposed condition of the head and neck compared with other parts, the protrusion of one eye from its socket, and the projection of the tongue between the lips as well as the absence of any natural cause of death, were medical proofs that deceased had died by strangulation, and not by any disease or accident. On the other hand, it was asserted that the deceased might have been accidentally suffocated while helplessly intoxicated by falling with his mouth on the pillow, or that he might have been carried off by a sudden attack of apoplexy or epilepsy. The discoloration of the face, the protrusion of the eye and tongue, and the discharge of fæces, might be accounted for by his dying during a convulsive struggle; while the two supposed indications of strangling afforded by the eye and tongue might be simply the result of the advanced state of decomposition in which the body was found. All the witnesses were agreed that there were no marks on the neck to indicate death by strangulation; but this want of physical evidence was accounted for by some of them on the theory that all such marks would be completely obliterated by putrefaction. The heart contained no blood, the vessels of the brain were empty, and the blood on the body was fluid and dark-coloured. The state of the lungs is not mentioned, nor the condition of the larynx and air passages, so that it is left uncertain whether any mechanical cause of obstruction existed in these parts. It was inferred by most of the witnesses for the prosecution that the marks of manual strangulation on the neck externally, and the usual appearances of asphyxia internally, had existed at the time of death, and that these appearances had been destroyed by putrefaction. Those who adopted this view contended that the protruding eye and tongue were conditions which had resulted from strangulation alone, and that they could not be produced by rapid putrefaction.

The alleged guilt of the prisoner rested chiefly on these two points. The facts showed, even allowing no more than twenty hours to have elapsed between death and the discovery of the body, that the prisoner must have been cognisant of the death; and unless hopelessly insensible from drink, which appears to have been disproved by the evidence, she would, it was suggested, if innocent, have given an alarm. She ultimately called to her son, and no reason can be assigned why she did not call for assistance earlier. It was impossible to assume that she was speculating on the rapid decomposition of the body, and watching for the stage when marks of violence would be obliterated. No motive could be assigned for the murder, nor for her remaining shut up in the same room with her husband, as was alleged, for four or five days. In these circumstances, with the admission by some of the scientific witnesses that the protrusion of the eye and tongue might have been caused by putrefaction, the jury returned a verdict of not guilty. There was nothing to preclude the possibility that the deceased might have died in an epileptic fit, as a result of excessive drinking. In any case it was obvious that the body had undergone rapid putrefaction. The greater decomposition observed in the head and neck might have arisen from the congestion of blood in the superficial vessels. As other causes besides manual violence may produce congestion of the head and neck, the blackening of these parts in a highly decomposed body furnished no medical evidence of homicide. The protrusion of the eye and tongue did not strengthen the theory of strangulation since it was properly admitted by some of the medical witnesses that these conditions were consistent with the effects of putrefaction in an advanced stage. There was, therefore, no medical evidence to show that deceased had died by violence ; and, instead of drawing the inference that such evidence had existed and had been destroyed by putrefaction, it would have been safer to have said that the highly decomposed state of the body prevented any correct medical opinion from being formed. No opinion went the length of affirming that death was necessarily produced by violence ; and the jury were informed by the judge that they were not to convict the prisoner on probability, however strong, nor on a mere preponderance of medical opinion.

It is strange that the protrusion of the eye as a result of putrefaction should have been doubted and even denied by some of the witnesses at this trial. So conflicting was the evidence regarding this appearance that Geoghegan made it a subject of experiment on the dead body of a child, and he observed that the eyes protruded as a result of decomposition on the eighth day, and they began to present the appearance of protrusion on the fourth day. A case of rapid putrefaction was reported in which both eyes protruded as early as sixteen hours after death. The time at which such an appearance may present itself after death must obviously depend on the period at which gaseous putrefaction takes place in the orbits. Although in the dead the eyes are usually collapsed owing to transudation of the fluids, yet it has been pointed out by Orfila that the lids may bulge forwards and the eyes protrude from the production of gases within the cranium and orbits.

R. v. *Mahaig* involved questions almost identical with those which arose at the trial of Mrs. Byrne.

On this occasion the body of a woman was found dead in a room in an advanced state of putrefaction. The deceased and her lover had retired to a bedroom some days before, and had kept themselves there secluded ; the man was found with his throat severely cut. This man was charged with the murder of the deceased by strangling her with a rope, and the medical questions to be solved were—How long had she been dead ? and, Did she die from strangulation or any other cause ? Taking the two questions in their order, it may be observed that the medical evidence showed that when the deceased was first discovered, on November 6th, at 6.30 a.m., she was lying on her back in bed, her body being covered with clothes as usual, the head and neck only being exposed. There was a pillow lying loosely over the face. There was no rigidity, and the hands were not clenched. The upper part of the body, including the head, neck, and shoulders, was very much decomposed. The skin of the face was so black that the features could not be distinguished. The tongue was protruded and swollen. The lips were everted and blown up with gas. Gases escaped from between the tongue and lips with a slight hissing sound. The abdomen was enormously distended with gas, and at the lower part much discoloured. On opening its cavity the intestines protruded. The liver was in a putrefied state. On cutting into the skin of the chest a large quantity of gas escaped; the lungs were found collapsed, and the heart was empty and contracted. Owing to the putrefied condition of the body, the head was not examined.

According to the evidence, the prisoner and deceased took the bedroom on November 3rd. The woman was seen on that night about nine o'clock, as well as the following morning. On the last occasion the landlady saw her face in bed. She was lying still, and, as she did not speak, the witness could not say whether she was then living or dead. It was observed, however, that of the two breakfasts taken up only one was eaten. From that time deceased was not seen alive. The prisoner came downstairs on November 5th at 9 a.m.; and the following morning the room was entered, and the body of deceased was then found in the state described. The prisoner was lying on the bed with his throat severely cut; the wound had obviously been inflicted some hours, and had bled a great deal.

From the time when the deceased was last seen living about sixty hours had elapsed. Inasmuch as the weather was close and damp, and the body shut up in a small room, there was ample time for the putrefactive changes described to have taken place, although such a degree of putrefaction is rarely seen until after the lapse of three or four days in warm, damp weather. It was therefore an exceptional instance of rapid decomposition, like those elsewhere described. The prisoner's statement was, that they had purchased poison on the 3rd, and had taken it on the evening of that day; and that the deceased died in his arms. In the afternoon, having left the room for a short time, he found on his return a cord round her neck, which he removed. The highly decomposed condition of the body was consistent with his statements; for although one day might be sufficient for such changes, they are seldom witnessed in less than two days. This would place the death of the deceased on the night of the 3rd.

The main question, however, was this: Had the deceased been strangled by the prisoner on that night, or did she die from any other cause? The putrefied condition of the body was consistent with either hypothesis, and it was a strong circumstance against him that he had remained in the room with the dead body. There was, however, an entire absence of motive for the alleged murder. No quarrelling or struggling was heard at any time by the people of the house. There were no marks of violence on her person indicative of struggling or resistance. It was proved, as prisoner had stated, that the deceased had on November 3rd purchased at a druggist's, under a false pretence, a threepenny packet of Butler's vermin-killer. This contains about one grain of strychnine, mixed with soot and flour. Several letters written by the prisoner, one apparently at the dictation or with the cognisance of deceased, referred to their mutual intention to destroy themselves;

and another, dated November 4th, stated that the deceased had taken poison and had died in his arms. With these facts, there was reason to believe that the deceased had really taken the poison which she herself had purchased, and had died from its effects. The stomach was examined chemically by the medical man who was first called in to see the deceased. He found it empty, containing only mucus with some black particles, the nature of which could not be defined. It was at first thought that it contained strychnine, but on making an analysis of the remainder of the stomach and the spirit in which it had been preserved Taylor found that it contained no strychnine. This negative result did not show that the deceased could not have died from the effects of a small dose of strychnine (half a grain) such as would be contained in one half of the packet which she purchased ; for such a quantity might have been removed by absorption, especially as the poison was taken on an empty stomach. The theory adopted by the medical men who examined the body was that deceased had probably taken strychnine, but that, before the poison had had time to operate fatally, she had been strangled by the prisoner by means of a rope placed round her neck.

As the head was not examined and the internal appearances of the chest did not support the theory of death by strangulation, it was sought to establish this view by the external appearances. Here, however, the same difficulty arose as in the preceding case. The advanced state of decomposition in the head and neck rendered the medical conclusions, to say the least, unsafe. The facts relied upon to show that the deceased had died from strangulation were (1) the black and decomposed state of the head and neck compared with other parts of the body ; (2) certain marks found on the neck, at the upper part, and chiefly on the left side ; (3) the peculiarly moist condition of the head and upper part of the neck and the drier appearance of the lower part, near the chest ; (4) the enormous distension of the head and the protrusion of the tongue between the lips.

The first and third reasons assigned indicate, not the cause of death, whether by violence, disease, or poison, but simply an advanced stage of putrefaction in conditions favourable to this. The surgeon who first inspected the body found, on the day following its discovery, three marks on the neck corresponding to three similar marks at the back part. There was no abrasion of the cuticle in front, nor any indentation or depression, but at the back the cuticle was peeling off as the result of putrefaction, and serum exuded from it. On removing the integuments there was no appearance of escape or coagulation of blood beneath ; and this is generally found in death from strangulation. The cellular tissue was much blown up with the gases of putrefaction. At the adjourned inquest before the coroner, while the facts were recent, the witness had thus described the appearances on the neck : " On the external surface of the neck there were two or three *indistinct* marks, most distinct on the left side. On removing the skin there was not the least escape of blood, but here and there the muscular tissue was more discoloured than the remainder." Another witness, who saw the body twenty-four hours later, described the marks as consisting of two or three lines of dark discoloration. There were no signs of violence beneath the marks, but the structures were of a darker colour below. He further stated that there was much blood beneath the skin from the chin to the chest, and on the arms there were apple-green streaks from putrefaction in the course of the blood-vessels. The protrusion of the tongue was referred by both, not to putrefaction, but to mechanical pressure on the neck as a result of strangulation.

A long clothes-line was found in the room under the bed. This was proved to belong to the landlady, who stated that it had been lying a long time in the room before it was let to the prisoner and deceased. On it were one small spot of coagulated blood, as if from a wound, and some long hairs of a female. When these were compared with some taken from deceased's head, there was found to be no resemblance.

Taylor's evidence on this part of the case, the cause of death, was to the effect that, as the deceased was not seen in the act of dying, any medical opinion on the cause of death must be speculative; that the non-detection of strychnine in the body was not inconsistent with the fact that a small but fatal dose had been taken by the deceased; that a rigid state of the limbs in a dead body would not be found where putrefaction had advanced to such a degree as in this case. Further, the external appearances did not prove that violence sufficient to cause death by strangulation had been applied to the neck of the deceased. The marks of discoloration on the neck, with the protrusion of the tongue, might have arisen from extreme putrefactive changes. Had they been produced by the application of a cord, such a degree of violence as would have caused the tongue to protrude would have produced indentation and depression of the soft parts of the neck, with an effusion of blood in the course of the depression and a ruffling or abrasion of the skin.

It was suggested by counsel that strangulation might have been produced by other and less violent means than by the use of the rope, and the slight appearances thereby produced might have been obliterated by putrefaction. It was admitted that this might happen, but there were no medical facts on which such an opinion could be based. The appearances were all consistent with putrefaction in an advanced stage, without resorting to the assumption that any violence whatever, sufficient to cause death, had been done to the neck. In the defence it was urged that the prisoner and the deceased had agreed jointly to take away their own lives; this was proved by the letters and their conduct. The deceased herself had purchased poison for this purpose, and had taken it, according to the prisoner's statement, on the evening of the day on which she procured it. Everything in the case was consistent with the theory of voluntary suicide and of an attempted suicide by the prisoner in a state of despair.

The jury found that the prisoner was guilty as an accessory before the fact, *i.e.*, that he was not guilty of murder by strangulation, but that he aided and abetted the deceased in the voluntary act of self-murder.

Here the cause of death was simply based on medical belief of probability, not on absolute certainty, which alone would justify a jury in coming to the conclusion that murder had been thus deliberately perpetrated. According to the prisoner's statement, the rope was really around the neck of the woman on the night of the 3rd, and he removed it. Assuming that the coloured marks on the neck arose from mechanical pressure, and not from putrefaction, it becomes a question whether the rope may not have been thus used by the deceased in attempting to strangle herself, or by the prisoner in aiding and abetting her in the attempt. Such a degree of pressure might be made on the part of the neck where those marks were found without causing death, and this would account for their presence without rendering it necessary to suppose that murder by strangulation had been actually perpetrated. The description does not convey the idea that it was impossible for deceased thus to have produced them, or that they could not have been produced without necessarily causing death; and thus there was nothing to support the hypothesis of murder but medical conjecture.

From all the facts of this case, it is in the highest degree probable that deceased took a portion of the powder containing strychnine on the evening of November 3rd, and that she died from its effects in the course of the night; that when her body was found she had been dead more than two days; that the prisoner aided and abetted her in the act of self-murder; that he was cognisant of her death, and was for at least two days in the room with her dead body without giving any alarm or calling for assistance; that he may or may not have taken part of the powder, but that, in accordance with their mutually expressed intentions, he had attempted to destroy himself by inflicting a serious wound in his own throat. The wound was not of that slight nature which is observed in wounds self-inflicted for the purpose of concealing or masking crime. He had lost much blood, and was depressed and faint when found.

In *R.* v. *Pile*, an unmarried woman was delivered of a fœtus which had respired, but there was doubt whether the child had lived. On March 22nd the mother took the body from the house; and on May 29th the remains were found loosely-covered with dry stable manure beneath a midden. The weather in the meantime had been for the most part dry and cool. When found the body, besides extensive injuries to the head, presented the following appearances: The abdomen was green, and the skin thereon was peeling in several places. The scrotum and penis, with the exception of the urethra, had disappeared; but the remains of the testicles were found. It was at first thought that the child had been dead not more than a week, but Stevenson was of opinion that it might have been dead seven weeks. The woman was convicted of concealment of birth.

These cases will serve to show that the changes produced by putrefaction in a dead body require more attention from the medical profession than they often have received. In alleged child-murder or infanticide it has been generally considered that a highly putrefied state of the lungs of the dead child prevents a correct medical opinion from being formed of the actual condition at birth; and it would be risky to infer from experiments on such lungs that a child had breathed after its birth The same caution should be observed in forming an opinion from the state of the skin when putrefaction is far advanced. The discolorations which here take place, especially in parts of the body in which the venous trunks and capillaries are congested from any cause at the time of death, are liable to deceive the examiner in cases where death is alleged to be due to violence.

Putrefaction, unless advanced to the last stage, cannot entirely destroy marks of violence when attended by physical injury to parts, such as abrasions or lacerations of the skin, laceration or crushing of the muscles with fracture of the trachea or larynx, protrusion of the tongue, accompanied by marks of indentation or laceration by the teeth. In such cases, a safe medical opinion may be formed in spite of the decomposed state of parts; but it is otherwise with superficial marks unattended with mechanical injury. These are precisely the appearances which occasion mistakes, as they may be really due to *post-mortem* changes, and not to violence. It is true that life may be destroyed by a slight degree of mechanical pressure, and the injury thus occasioned may be masked or obliterated by putrefaction. There is, however, this conclusion to be drawn: it is far better that a few cases of real homicidal violence should thus escape detection than that we should incur the serious risk of involving an innocent person in a charge which on conviction might lead to capital punishment. Murder by strangulation is murder in its worst and most aggravated form. The act itself implies malice and deliberate design. If the body is not decomposed, we may act safely; if decomposition has advanced to a great degree, whether generally or locally, it would be unsafe to base an opinion on superficial discolorations only.

Effects of Disease, Poison, or Violence v. Post-mortem Changes or Decomposition

Some of these have already been incidentally mentioned in the systematic description of *post-mortem* changes :—

Bruises *v.* Hypotases, p. 183.

Hypotases *v.* Inflammation, p. 183, also *infra.*

There are, however, one or two others which must be referred to.

Post-mortem Changes v. Poisoning. Owing to *post-mortem* changes in dead bodies various discolorations take place on the mucous surface of the stomach and bowels, often closely simulating the effects of poison. The mucous membrane of the stomach may be found of various tints, from a red-brown, becoming a brighter red by exposure to the air, to a deep purple or slate colour, and sometimes black from decomposition of the blood. At the points where the stomach is in contact with the spleen or liver the lividity is often well marked and clearly defined through all the coats. The peritoneal or outer coat is of a greenish hue, and the course of the superficial vessels is marked by greenish brown or black lines, all of which may be due (and are in fact in ordinary cases due) to bile which has soaked from the gall bladder (*vide* p. 57). These spontaneous changes, which are the result of putrefaction, may be easily mistaken for the effects of irritant poisoning. There are no rules that will always enable a medical jurist to distinguish such cases. Much must depend on the progress of putrefaction and the period after death at which the body is examined, and especially on the experience and acumen of the pathologist. Hence each case must be judged by the circumstances which attend it. We may presume that the redness has taken place during life, and is not a result of *post-mortem* changes: (1) when it is seen soon after death; (2) when it is met with in parts not dependent, nor in contact with other organs gorged with blood; (3) when it is accompanied by a considerable effusion of coagulated blood, mucus, or flakes of lymph, the result of ulceration, corrosion, or destruction of the coats of the viscera; (4) if decomposition has not advanced too far, an effort may be made to strip off the mucous membrane of the stomach; if it separates readily, this is suggestive of irritant poison. If death has been preceded by severe vomiting from *any* cause, small submucous hæmorrhages may sometimes be seen, so that their presence is not necessarily indicative of an administered poison. When the body is not inspected until a long period after death it is difficult to distinguish these pseudo-morbid appearances from those depending on the action of irritant poison. In a really doubtful case it is therefore better to withhold an opinion than to express one which must be purely conjectural.

It must be remembered that the contents of the stomach may be of more importance than its condition. Moreover, if the irritation is due to mineral irritants, it is practically certain that traces of the substance will remain. Vegetable irritants (bits of leaves, berries, flowers, etc.) are likely to be recognised, though naturally liquid preparations of vegetables, or even of minerals, may have disappeared.

It is impossible to assign a definite time at which the effects produced by irritant poisons are destroyed by the process of putrefaction. If the poison were of an antiseptic character, and the body had been speedily buried, a decided redness of the stomach, as a result of inflammation, may be perceived after five or six weeks. On one occasion the effects of arsenic on the mucous membrane of the stomach were distinguishable in the case of a child whose body had been interred for a period of twenty-eight days, and in two other cases, in which the viscera were well preserved, they were so after a year and nineteen months respectively. Of course, when the inflammation is only slight, its results will be much more speedily obliterated, or merge in the redness caused by decomposition.

Again, melanosis in the stomach—*i.e.*, a deposit of black colouring matter beneath the mucous coat—might be mistaken for the effect of sulphuric or oxalic acid or caustic alkalies; but melanosis is unaccompanied by any marks of inflammation, corrosion, or destruction in the mucous membrane beneath, and it is always seen in well-defined spots.

Perforation of Stomach. On p. 57 we have drawn attention to the difference between *post-mortem* perforation and disease. If poison has caused the perforation the signs of peritonitis will be even more marked than in disease.

Deductions from Putrefaction as to how long a Body has been in Water

Some attempts have been made to generalise on the phenomena of putrefaction in water in order to enable us to say for how long a period a body may have been immersed. No satisfactory data, however, have been obtained to guide us in this inquiry. The changes which take place are modified in their degree and the rapidity of their progress by numerous and often inappreciable causes. Devergie believed that he had obtained a certain series of characters whereby he could determine with sufficient precision the length of time during which a dead body may have been in the water, supposing the drowning to have occurred during the winter season. Thus, according to him, in bodies immersed *from three to five days* we shall find:—Cadaveric rigidity; coldness of the surface; no contraction of the muscles under the galvanic stimulus; and a white or sodden appearance of the skin of the hands. From *four to eight days:*—Pliancy of all parts of the body; no muscular contractions under the galvanic stimulus; natural colour of the skin; cuticle of the palms of the hands very white. From *eight to twelve days:*—The whole of the body flaccid; the cuticle of the back of the hands beginning to whiten; the skin of the face softened and pallid, differing from the skin of other parts of the body. About *fifteen days:*—The face somewhat bloated and covered with red patches; a greenish tint in the middle of the sternum; the cuticle of the hands and feet perfectly white, and becoming raised in folds. About *a month:*—Face of a reddish brown colour; eyelids and lips green; a reddish brown patch surrounded by a green border on the fore part of the chest; the cuticle of the hands and feet white, thickened, and corrugated. About *two months:*—Face brownish-coloured and swollen; the hair becoming loose; the cuticle of the hands and feet in great part detached; the nails still adherent. *Two months and a half:*—Cuticle and nails of the fingers detached; the cuticle of the feet detached, but the nails still adherent. In the female there is a reddish colour of the subcutaneous cellular tissue in the cervical region, as well as that which surrounds the windpipe and the organs contained in the chest; partial saponification of the cheeks and chin, superficial in the breasts, groins, and fore part of the thighs. *Three months and a half:*—Destruction of part of the scalp, eyelids, and nose; partial saponification of the face and of the upper part of the neck and groins; destruction of the skin in different parts of the body; cuticle of the hands and feet as well as the nails entirely detached. *Four and a half months:*—Almost complete saponification of the fatty part of the face, neck, groins, and fore part of the thighs; the appearance of a calcareous incrustation or deposit on the thighs; opalescent condition of nearly the whole of the skin; destruction and removal of the hairy scalp; the bones of the skull laid bare and beginning to become brittle. There are no data to give even approximate opinions for a longer period than this; and it is admitted that even these imperfect data are not available for determining the period of death in subjects drowned during spring and summer.[1]

In attempting to fix the time of death from the extent of destruction of the parts, the examiner must remember that crabs, eels, etc., attack the body within an hour or so of immersion, and may remove most of the exposed soft parts in a few hours.

There is a common belief that the dead human body is soon destroyed by submersion in water; but this is not borne out by experience In those who are drowned during winter, and whose bodies remain long below the surface, or are covered with mud so as to prevent a free access of air, decomposition takes place slowly.

A man found in the sea off Portobello after twelve weeks' immersion shewed the skin fairly intact, but loose and discoloured, distention of the abdomen, and a fairly good state of preservation of the internal organs. In the body of a man immersed for five months in the sea the cheeks and remains of the scalp were transformed into adipocere, but the rest of the body was practically intact.

A case occurred in which a man, *æt.* 70, was missing from January 6th to February 4th. His body was found in a river, and there was reason to believe that he fell in and was drowned on the day when he was last seen. The head, neck, and a portion of the chest, where unprotected by clothing, were thickly covered with mud. When this was removed, the features were perfectly recognisable, and although twenty-eight days had elapsed, identification was easy. The only changes observed were as follows: The cuticle peeled away from the cutis when slight friction or pressure was made over those parts which had been covered with mud.

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[1] See also Harvey Littlejohn, *Edin. Med. Jour.*, 1903, and "Forensic Medicine," 1925 p. 41.

the face and neck were somewhat darkened in colour, and the front part of the chest was marked with slight lines of lividity. There was no tumefaction whatever over any part of the body. The thickened skin of the hands and feet were corrugated and whitened by long-continued maceration, but remained firmly adherent to the tissues beneath it. With these exceptions, the body presented no appreciable alteration of appearance, nor any departure from that which would be observed in a recently dead body.

In another case some parts of the body of an infant were found floating on the surface of water in a pit. There was the skull with the sodden skin upon it, but the brain, eyes, and ears had disappeared. The upper part of the chest and one arm were found. The soft parts appeared to enclose the bones, which were quite loose and discoloured, but saturated with water. Some of the articular cartilages were still attached, although very much softened and easily separated. There were the remains of a woollen cloth in which the body was probably wrapped; it had been kept at the bottom of the water for some time by a heavy stone found there, which was no doubt attached to the body.

Upon these facts, the questions submitted to Taylor in reference to a woman delivered of a child eighteen months previously and suspected of murder, were whether it was possible that a human body could remain so long a time as eighteen months in water without being totally destroyed and further, whether the action of water would not increase the bulk of the body, so as to make a new-born child appear some weeks old. The answers to these questions were (1) that a dead human body submerged is not necessarily destroyed in eighteen months: and, in reference to this case, it appears probable from the description that the body had been immersed for a longer period; (2) that in the early stages of gaseous putrefaction the body may appear larger from general distension, but this stage had been long passed in reference to these remains. Although this was probably a case of infanticide, there were no data to determine whether the child had been placed in the water living or dead.

The following is a remarkable instance of the effects of water on the human body after submersion for the long period of twenty-six years:

A healthy muscular man, *æt.* 24, fell into the shaft of a mine fifty fathoms deep, of which thirty fathoms consisted of water. The efforts to recover the body were unsuccessful. The shaft was closed over, and so it remained for 26 years, when the working of the mine was resumed. The skeleton of the missing miner, with portions of the clothes which he wore, was discovered in one of the levels, in which there was water. The remains, as well as the clothes, buttons, and boots found on the skeleton, were identified by his brother. All the soft parts, with the exception of a small piece of fatty substance, were destroyed, but the bones were firm and well preserved. There was no muscle, tendon, ligament, or even cartilage about any of them. They were all detached from the joints, and were of a dirty brownish or almost black colour. The skull was full of a brown soft substance, which was without smell. There was nothing in the water calculated either to destroy the soft parts or preserve the bones.

It is not often that a precise opinion is required of a medical witness respecting the probable period at which death has taken place from drowning (*vide* "Drowning" for further reference). (In 2 Casper, E. Tr., p. 261, is a useful account of "*The Progress of Putrefaction in Water.*")

CHAPTER VIII

LEGAL PRESUMPTION OF DEATH AND OF SURVIVORSHIP

Inasmuch as a person who has been presumed to be dead may possibly reappear and require identification, there is a certain propriety in discussing this subject under the general heading of "Death."

Although the English Courts are called upon frequently to deal with applications arising out of the presumed death of persons who have disappeared in various circumstances, medical evidence is rarely necessary except in certain rare cases.[1]

In cases where a missing person is shown, prior to disappearance, to have been suffering from a serious disease which was likely to prove fatal in regard to which he may have received medical advice, testimony by medical witnesses might assist the Court in coming to a conclusion, by showing the stage to which the disease had advanced, and the probability of its causing death within a certain period. No general rules to govern such cases can be laid down; each case must depend upon the circumstances which accompany it.

The presumption of death after the expiration of seven years from the date when the missing person was last heard of is the general rule of law.[2] In the Probate Court, where such applications are frequent, this rule is not recognised as absolutely binding.

The Probate Court does not presume the death of the alleged deceased; but, after hearing the facts, merely gives the applicant leave to swear, for the purpose of obtaining probate or letters of administration, that the deceased died on or since a certain date.

Cases have occurred where the presumed deceased has returned after the Court's decision granting leave to swear his or her death. The following is a case in point:

An application was made for the rescission of an order made on March 28th, 1904, for leave to presume the death of Ellen Cook. The case had been reported in the press, and had in this way been brought to the notice of Ellen Cook, who since her disappearance twenty years previously, had been married again to a man named Atherley, with whom she had been living at Upper Sutton Street, Aston Manor, Birmingham. Mrs. Atherley communicated with the solicitors concerned. Subsequently she was identified by her niece, Mrs. Thomas Beck, and by a Mrs. Olive Beck. No grant of administration had been made under the order, as the fact that Mrs. Atherley was alive had been ascertained before there was time for such grant to be made.

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[1] *E.g.*, to prove that a girl of sixteen died unmarried and without issue: to prove that a woman was a widow: to defend a charge of bigamy: to obtain a legacy: to obtain insurance money.

[2] If it be alleged that a person was, as a matter of fact, alive on any given day in those seven years, it is incumbent upon the one who makes the allegation to prove the fact by positive evidence.

The President of the Probate Court having considered the evidence, said that he was satisfied as to the identity of Mrs. Atherley: and he accordingly rescinded the order of March 28th, 1904.

During and after a war there are many applications to the Court for leave to presume the death of service men (and sometimes civilians) reported as "missing." Before making the desired order the Probate Court always required cogent evidence, concerning the movements of the presumed deceased. The disinclination of the Court to make such an order without strong evidence has been justified by the fact that many persons reported as "missing, but believed to be dead," have been ascertained subsequently to have been taken prisoners of war.

PRESUMPTION OF SURVIVORSHIP

Since 1st January, 1926, the law as to survivorship where death takes place in a common calamity ("*commorientes*") has been revolutionised; for by the Law of Property Act, 1925, s. 184, it is enacted that in all cases where two or more persons have died in circumstances (such as shipwreck, battle, earthquake, or motor car collision) which render it uncertain which of them survived the other or others, such deaths shall (subject to any order of the court) for all purposes affecting the title to property be presumed to have occurred in order of seniority; and, accordingly, the younger shall be deemed to have survived the elder.

This enactment renders obsolete the decision in the old case of *Wing* v. *Angrave.*[1]

Direct Evidence of Survivorship. This, if reliable, is obviously the strongest evidence which can be given.

Provided there be some direct evidence, a very small amount of proof is required for survivorship.

A father and son were entitled to land as joint tenants. Both father and son were hanged at the same time in one cart; but because the son, as deposed to by some of the witnesses, survived, as appeared by the shaking of his legs and probably some other tokens, the wife was held entitled to an interest in the land to which she would not otherwise have been entitled.

The following case occurred in America:

Hugh Swinton Ball, with his wife and adopted daughter, was lost on board the steamer *Pulaske*, on the coast of America. By his will Ball bequeathed his property to his wife, and a claim was made by her heirs on the ground that she had survived her husband. It seems that an explosion took place on board the steamer at eleven o'clock at night, and that husband and wife were at the time in different parts of the vessel, and were thus separated from each other. Mr. Ball was not seen after the explosion, and, although he perished with many others, the precise time at which he died could not be determined. Mrs. Ball was seen after the explosion, rushing in a terrified manner about the deck, calling for her husband, but no reply was made. She was soon afterwards missed, the promenade deck, to which she had retreated, having been submerged with herself and all who were on it. Chancellor Johnson, before whom the case was argued, said that it was a case to be decided by testimony, and as the right on the part of Mrs. Ball was derivative, the burden was on the plaintiffs to prove that she was the survivor. The evidence regarding the non-appearance of Ball, when, had he been living, there was sufficient time for him to have shown himself with others on deck, and to have made an effort to join his wife, was considered by the Chancellor to be conclusive of his death at the time that the wife was seen and recognised by many who knew her. On these considerations he decided in favour of the plaintiffs, that the wife survived the husband, and, therefore, she succeeded to his estate. On appeal, this decision was confirmed.

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[1] 8 H. L. C. 183.

This case is peculiar in that the wife alone was seen living, and the nature of the accident was such as to render it probable that the husband had perished in the explosion. The counsel for the defendants ingeniously argued that as the death of the wife could be fixed, whereas that of the husband could not be fixed, it was fair to presume that she died first; but this argument failed to satisfy the Court. The plaintiffs were not required to prove when the husband died; they established sufficient to render it probable that the wife was the survivor.

For a case where the medical evidence of survivorship in an aeroplane smash was held to be inconclusive, see *Lancet*, 1926, 1, 515.

In *Hickman v. Peachey* (1945), W. N. 153, the House of Lords held that where the evidence was inconclusive the statutory presumption applied.

Death of Mother and Child in Parturition. For a case where a husband and a wife were killed by an explosive bomb during an air-raid where the evidence was not sufficient to rebut the statutory presumption, see *In re Lindop.*[1]

On this subject Tidy wrote as follows[2]:—

"*Death by Parturition.*—If mother and child both die in childbed without witnesses, the presumption is that the mother survived the child For, *first*, there is a *primâ facie* probability of the child being still-born, and that a woman in childbed without attention or attendance will be unable to render her child the assistance necessary for its preservation. *Secondly*, a large child, or marks of a difficult labour, or the absence of the signs of respiration, would suggest the death of the child as occurring before that of the mother. Thus, from both points of view, the presumption of survivorship in those rare cases where mother and child both die is in favour of the mother.

"We agree with most medical jurists that those who assert that the child survived the mother should be required to adduce definite evidence of their contention. At the same time, it must be remembered that although the child may die from cold, or from suffocation, or from its being of unusual size, or from protracted labour or from labour complicated with convulsions, or from pressure on the umbilical cord, or from partial detachment of the placenta, and other causes, nevertheless the mother runs the risk (and that risk a very dangerous one) of hæmorrhage. Again, it is quite conceivable that a mother might give birth to a child and herself tie the cord, and then die of syncope from the exhaustion consequent on the effort, whereas the child would be temporarily safe."

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[1] 1942 Ch 377.

[2] "Leg. Med.," p. 393.

CHAPTER IX

WOUNDS AND PERSONAL INJURIES

As the next few paragraphs deal with violent death, the following tables are not without interest:

DEATHS FROM SUICIDE AT ALL AGES IN ENGLAND AND WALES IN 1940

	Males.	Females.	Total.
On railways	86	32	118
Firearms	262	21	283
Cutting or piercing instruments	319	59	378
Crushing	11	2	13
Solid or Liquid Poisons and Corrosive Substances	219	271	490
Poisonous gas	966	763	1,729
Drowning	369	237	606
Hanging or strangulation	546	161	707
Jumping from high places	103	64	167
Other means	13	13	26
	2,894	1,623	4,517

ENGLAND AND WALES. DEATHS FROM HOMICIDE IN 1940

Method of Homicide.	Males.	Females.
Firearms	8	23
Cutting or piercing instruments	14	11
Infanticide (infants under 1 year)	19	15
Other means	31	49
	72	98

GENERAL WOUNDS

Legal Considerations :

- Offences against the Person Act, 1861.
- Definition of a Wound—Bruise—Lacerated Wound—Punctured Wound—Ecchymosis or Effusion—Stabs and Cuts.
- Weapons—Need not be Defined.
- Grievous Bodily Harm.

Wounds—

- Points to be Noted in all Wounds.
- Is the Wound dangerous to Life?
- Is it, if not immediately dangerous, likely to leave Permanent Injury?
- Was it, or were they, the cause of death (a) directly, or (b) indirectly?
- Which of two Wounds caused Death?
- When was the Wound or Bruise Inflicted?
- With what Weapon or how was it Inflicted?
- Was it Inflicted during Life or after Death?
- If before Death, how long did the Victim survive? including, What could he do in the Way of Movement?
- If before Death, was it Accident, Suicide, or Homicide?
- Wounds of Special Regions.
- Feigned or Self-inflicted Non-fatal Wounds.

LEGAL CONSIDERATIONS

Offences against the Person Act, 1861 : Sect. 11, " *Whosoever shall by any means whatsoever wound or cause any grievous bodily harm to any person with intent to commit murder shall be guilty of felony.*"

Sect. 18 : " *Whosoever shall unlawfully and maliciously by any means whatsoever wound or cause any grievous bodily harm to any person, or shoot at any person, or, by drawing a trigger or in any other manner, attempt to discharge any kind of loaded arms at any person with intent, in any of the cases aforesaid, to maim, disfigure, or disable any person, or to do some other grievous bodily harm to any person . . . shall be guilty of felony.*"

Sect. 20 : " *Whosoever shall unlawfully and maliciously wound or inflict any grievous bodily harm upon any other person either with or without any weapon or instrument shall be guilty of a misdemeanour.*"

Definition of a Wound. The preamble to the *Offences against the Person Act*, 1861, states that " it is advisable to consolidate and amend the law relating to offences against the person." The Act contains no definition of a wound : but it has been held that to constitute a wound within the statute, the continuity of the skin must be broken ; in other words, the outer covering of the body, *viz.*, the *whole skin*, not merely the cuticle, must be severed.[1] A division of the internal skin—*e.g.*, within the cheek or lip—is sufficient to constitute a wound within the statute ;[2] but it is not sufficient to prove merely that a flow of blood was caused.[3]

[1] *R.* v. *M'Loughlin*, 8 C. & P. 635.

[2] *R.* v. *Smith*, 8 C. & P. 173.

[3] *R.* v. *Jones*, 3 Cox C.C. 441.

A Wound is a Solution of the Natural Continuity of any of the Tissues of the Living Body

This definition expressly omits—

(1) Any reference to the effusion of blood, for it is quite possible either to wound or to cause grievous bodily harm to a person without causing the effusion of blood. A wound of the cornea of the eye, for example, may result even in death without spilling of blood; and, in ordinary medical parlance, we speak of abrasions and injuries of the cornea as wounds of the cornea.

(2) Any allusion to the skin being severed. Why should the skin be the only tissue in the body the laceration of which constitutes a wound, when in ordinary medical conversation one is constantly referring to wounds of the liver, of the spleen, of the intestines, etc., etc.?

(3) Any allusion to the nature of the tissue damaged. Why should a fractured bone, or a dislocated joint, not be a wound?

(4) Any allusion to the cause of the solution of continuity; disease produces wounds as easily as a knife, though not by the same process.

The overwhelming advantages of the definition are that it includes bruises, the effects of burns from fire and heat and electricity, the effects of any corrosive liquid or solid, all lacerations and bruises of internal organs and tissues; it prevents any possible quibble about the skin being or not being severed; it make no reference to how or by what means produced; it is short and simple, and is constantly being used in professional discussions in relation to all organs; it assuredly includes all dislocations of joints and fractures of bones, and rightly so, for they in turn include some of the most severe injuries and "grievous harm" that can be done to a limb.

If it be objected that the law did not intend to include slight scratches from finger-nails, pin-pricks, and trivial wounds of this description, it may be retorted, from a medical point of view, that many of these, and especially small punctured wounds from a septic or dirty instrument, are more dangerous to life than many open wounds.

Having thus defined a wound in general terms, it is easy to define other injuries and bring them under the same heading.

A Bruise or Contusion is a wound of such a nature that the solution of continuity affects one or more bloodvessels in such a manner that blood effused from the rupture of the vessel is unable to escape freely from the surface either of the severed skin or of the organ in which the solution of continuity is situated. In the case of organs, such as the cornea of the eye or the cartilages of bone, which have no blood-vessels, a bruise may be defined as a crushing of the tissues producing a solution of continuity in them. In common language, the terms bruise and bruising generally refer to the blood which is effused in consequence of the rupture of a vessel or vessels and to the tissues amongst which this blood has soaked; they have no reference to the wound which allowed the effusion to take place.

A Bruised or Contused Wound is a wound in which a good deal of the blood has escaped from the solution of continuity, but some has been effused into the surrounding tissues.

A Lacerated Wound is a wound the edges of which are irregular and not clean cut. This term usually refers to injuries from blunt instruments in which the tissues are torn.

A Punctured Wound is one in which the depth (measured from the surface of the wounded part) is great in proportion to the length (measured along the surface of the wounded part).

Ecchymosis or Effusion. Inasmuch as these two words are frequently used by medical men in describing injuries, it is well to draw attention to their meanings. They both mean in our present connection the same thing, *viz.*, a pouring out, and they are applied to the outpouring of blood amongst the tissues which follows a solution of continuity of a blood-vessel. Custom has to some extent limited their uses below their strict meanings as given above. Thus it is only a very small outpouring of blood, say about a few millimetres in size, that is spoken of as an ecchymosis. For instance, the little spots of escaped blood beneath the pleura in asphyxia are commonly spoken or as ecchymoses or ecchymosed spots (often also called **petechiæ**). It is advisable for a medical witness to avoid the terms in giving evidence and use the term bruise when he wishes to indicate that blood has escaped into the tissues as the result of violence. If he thinks the escape was due to disease, let him say so in plain language : " The spots that I saw looked as though they were due to bruising from violence, but in my opinion they were due to disease." This is pre-eminently the occasion for the use of terms which cannot be misunderstood by laymen.

Stabs and Cuts. Formerly these were distinguished from wounding, and many acquittals took place owing to this distinction. This is removed by the Offences against the Person Act, 1861, and need not be touched upon. At the same time a medical witness should be prepared to describe fully the injury which he terms a wound.

What are Weapons ? Those legal doubts which formerly arose in reference to the true signification of the term *weapon* have been removed by statute. Thus the teeth, the uncovered hands or feet, were formerly held by the judges *not* to be weapons ; and injuries produced by them, however severe, were not treated as wounds within the meaning of the statute. Parties were tried on charges of biting off fingers and noses, and although the medical evidence proved that wounds of a severe kind had been thus inflicted, and that great disfigurement and mischief had been done to individuals, yet the nature of the injury produced was not so much regarded, as the actual method by which it was accomplished. The persons charged were acquitted under an indictment for " wounding," since wounds in a legal sense could be produced only by weapons, while the teeth, hands, and feet were not weapons in law.

During a trial many years ago the prisoner's counsel claimed for artificial arms and legs the same privilege of exemption that was accorded to natural arms and legs. It was argued that a wooden arm with an iron hook at the end of it, with which an assault was committed, had become, by long use, part of the body of the prisoner, and that, like a natural arm, it ought not to be considered a weapon in law ; but the contention was disallowed.

Except in so far as the deliberate use of a weapon may indicate an intent to inflict a greater amount of personal injury, such questions as these cannot now arise.

Hatpins are distinctly to be held as weapons, and may be very dangerous.

A young married woman was sentenced to twelve months' hard labour for maliciously wounding a man. The accused, while drunk in a public-house, had struck the landlady. The man went to the latter's assistance, and when he had ejected the accused, she rushed at him and struck him in the eye with a hatpin. The eye had to be removed; and it was feared that the injury would cause total blindness to the other eye.

Grievous Bodily Harm. With such a comprehensive definition of a wound, there is very little positive ground left for these words to cover. They might include shocks from electricity which did not burn, tight ligatures placed around limbs or around the penis, foreign bodies inserted into rectum or vagina, burns that did not wound (first degree, or mere redness), the throwing of liquids which are not corrosive, merely staining or irritating the skin, and possibly a few other injuries: but with these, as with wounds, the *intent* with which they were inflicted is of more importance in some ways than the injury itself.

In *R.* v. *Davis* a man was charged with wounding with *intent* to do grievous bodily harm. It appeared from the evidence that the prisoner, half drunk, and during a quarrel, suddenly stabbed the prosecutor, inflicting a dangerous wound, with which he was laid up for a month. For a fortnight he was in danger. It was contended that there was no intent to produce grievous bodily harm.

The Judge said that the jury might satisfy themselves on that point by considering the circumstances of the case. Could a man inflict such a wound without having an intention to inflict grievous bodily injury? The prisoner was not so drunk as not to know what he was doing, and all the circumstances showed premeditation and intention, *viz.*, the nature of the wound, the weapon used, and the part of the body struck, where an injury was so likely to be dangerous. The prisoner was found guilty of the intent. In cases of this description, the intent with which a wound was inflicted is usually proved by non-medical evidence.

In April, 1904, at Market Deeping, in Lincolnshire, an extraordinary event happened in which there was inflicted "grievous bodily harm" resulting in death.

The victim was on the ground with a second person lying on the upper part of his body, while a third passed the nozzle of a force-pump[1] through a hole in the victim's trousers and up his anus, and then turned the stopcock, allowing air to rush into the intestine. On admission to an infirmary the abdomen was highly distended with gas. The lower outlet of the bowel was dilated, and the bowel pushed down into it. A tube could not be pushed either through deceased's mouth or his anus, he was so tightly blown up. He died very soon after the event. The following day a medical witness made a *post-mortem* examination, when he found ruptures of the gut. Eight inches from the outlet there were two rents, one one and a half inches long, and the other three-quarters of an inch long, which might have been caused by the nozzle of a pump. The gut around the vent was gangrenous and congested, which might have been caused by peritonitis, due to the rupture of the gut. There were no marks or bruises on the body of the deceased. The medical witness could not say whether the pipe had been put up the anus.

Several cases of a similar nature, occurring in works where compressed air is used, have since been reported. The force of the issuing stream of air is so great that it is not necessary to have a hole in the clothing for "grievous bodily harm" to ensue.

At the Central Criminal Court in February, 1904, in *R.* v. *Jarvis and Mudd*, pouring boiling water over a woman was held to be grievous bodily harm.

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[1] The pump was one of those used to free gas-pipes in winter from accumulations of solid matter. Air is pumped into a chamber at considerable pressure, and is then suddenly released by turning the stopcock so that air rushes violently through the nozzle to force out any obstacle.

POINTS TO BE NOTED IN THE EXAMINATION OF WOUNDS

In every wound that a medical witness is called upon to examine, the following points should invariably be attended to, and the results *written* down as soon as possible.

1. Number.
2. Position, including the organ wounded.
3. Direction.
4. Depth, at ends especially.
5. Length or size.
6. Nature (punctured, incised, lacerated, bruised, etc.).
7. Condition of edges (jagged, bruised, etc.).
8. Condition of ends, undercut or not.
9. Foreign bodies such as fragments of metal, glass, hair, dirt, etc.
10. Hæmorrhage and its amount.
11. Inflammatory reaction and processes, swelling, pus, scabs, granulations, etc.

Each of these may be of vital importance for drawing accurate conclusions when a medical man ceases to be a common witness of fact, and commences his more appropriate function of giving expert evidence. Each wound must be described so that it can be accurately localised and precise measurements of the size, depth, etc., must invariably be taken. A photograph or sketch showing the position and size of the wounds is desirable.

It is impossible to impress too strongly on the mind of a medical witness that in describing the wounds which he has found during the examination of a body he should use plain and simple language, and avoid as much as possible the use of technical or professional terms. The natural desire of a good witness is to make himself understood ; but this cannot be accomplished if he clothes his ideas in language which is incomprehensible to educated men of the legal profession, and *a fortiori* to the class of men who constitute juries. A medical witness should, for his own credit and for that of the profession to which he belongs, employ plain and simple language in describing a wound, as well as in giving his evidence generally.

In the medical reports on the examination of bodies of wounded persons, care should be taken to avoid the introduction of any remarks in the form of inferences from or comments on, the non-medical facts of the case, and even on the medical facts comments and inferences should be carefully separated from the facts. At the trial of McLachlan the Judge objected to the statements in the medical report " that the body of deceased had been found under circumstances of great suspicion," and " that there were marks of a severe conflict." When the witness was cross-examined on the medical fact which led him to the conclusion that there had been a " severe conflict," it resolved itself into the statement that there were marks of blood on the flags which indicated that the body had been dragged along the floor *after death* ; but he was unable to mention any medical facts by which this form of expression could be justified.

IS THE WOUND DANGEROUS TO LIFE ?

The meaning of the words *dangerous to life* is left entirely to the professional knowledge of a witness. It is not sufficient on these occasions that he should make a simple declaration of the wound being dangerous to life ; he must, if called upon, state to the court and that usually in writing, satisfactory reasons for this opinion ; and these reasons may be rigorously inquired into by counsel for the defence.

Danger to life primarily depends upon hæmorrhage, shock or damage to a vital organ ; and secondarily on the chance of secondary hæmorrhage, infection leading to septicæmia, pyæmia, tetanus, gas gangrene, infection of particular organs causing meningitis, pleurisy, empyema, pericarditis, peritonitis ; or more remotely to the effects of scarring, causing stricture of the urethra, ureter, œsophagus, gut, etc.

As a general principle, the court is likely to consider as dangerous to life in a legal sense only those wounds in which the danger is imminent. The law appears to contemplate the direct, and not the future or possible occurrence of danger ; if the last view were adopted, it is clear that the most trivial lacerations and punctures might be pronounced dangerous to life, since tetanus and other infections proving fatal have resulted from very slight injuries. A difference of opinion will often exist among the medical witnesses, whether a particular wound is or is not dangerous to life. Unanimity can be expected only when the judgment and experience of the witnesses are equal. The rules for forming an opinion in these cases will, perhaps, be best deduced from the results of the observations of good surgical authorities in relation to injuries.

For dying declarations in serious injuries *vide* " Dying Declarations."

IS THE WOUND LIKELY TO LEAVE PERMANENT INJURY ?

The only connection in which this question can arise is either when considering compensation in cases of accident (*vide* " Workmen's Compensation Act ") or when a judge is considering what sentence ought to be passed upon the assailant.

The answer to this question may be obvious in cases in which there is actual immediate loss of eye, limb, or member. In other instances the possibility of permanent damage may depend on the nature of the wound and the possibility of such sequels as sympathetic ophthalmia, possible gangrene from damage to vessels, severe injuries to nerves, amount of inflammation, chances of septicæmia, etc.

Scarring and its effects, producing contraction, keloid, etc. ; the effects on muscles, bones and joints leading to stiffening and loss of function, damage to the central nervous system, leading to immediate physical effects or to psychical or other lesions less easy to trace to their origin; and lowering of the resistance of the tissues leading to secondary diseases or to malignant growths must also be considered.

Wounds of the face, when at all extensive, are always followed in healing by greater or less *deformity*. A medical witness may, perhaps, have the following questions put to him : Is the wound likely to result in deformity ? Could such a wound of the face heal without deformity ? or, Could the deformity, if it exist, have been produced by any cause other than the wound ? These questions are of importance. A person may allege that he was severely wounded in the face, whereas the medical witness, upon examination, may find no trace of such a wound as that described. Again a person may seek damages in a civil action on the ground that a particular deformity was produced by a wound, whereas the medical witness may be able to trace its origin to disease, or to some accidental cause.

WERE WOUNDS OR A WOUND THE CAUSE OF DEATH ?

In all cases where wounds have been criminally inflicted, and death ensues, a medical witness must be careful not to state that the wounds caused death unless he is reasonably certain that these wounds caused the death.

No man ought to be convicted upon mere medical probability. As a rule there is only one principal cause of death, although other circumstances may have assisted in bringing about a fatal result. Hence it is essential when several apparent causes for death exist, to determine which was the principal cause, and, in stating it to the court, to be prepared to offer reasons for that opinion. In most cases of local injury, when a person dies quickly, there should be no difficulty in determining whether disease or the wound was the cause of death. There may be difficulty when a person who has recovered from the initial effects of a wound, subsequently dies. Besides, there may be cases in which the cause of death, in spite of the most careful consideration, is still obscure ; or sometimes it may happen that the death of a person appears to be attributable as much to bodily disease as to an injury proved to have been received at the time when he was suffering from disease. How is an opinion to be expressed in such a case ? The course which a medical witness ought to pursue, provided he has duly considered the circumstances before he appears in court, and his mind is equally balanced between the two possibilities, is at once to state his doubt without circumlocution, and not to allow his doubt to be extracted from him in cross-examination.

In all cases a complete autopsy should be made in order to ascertain the actual cause of death. For example, a man falls in front of a train or heavy waggon and is apparently crushed to death. Without an autopsy it cannot be proved that cerebral hæmorrhage did not cause the fall.

Wildberg was called upon to examine the body of a girl who had died, apparently from the effects of the violence suffered while her father was chastising her for stealing. On the arms, shoulders, and back many marks of blows were found : and under some of them blood was effused in large quantity. The injuries, although severe, did not, however, appear sufficient to account for sudden death. He therefore proceeded to examine the cavities, and on opening the stomach he found it very much inflamed and lined with a white powder, which was proved to be arsenic. It turned out that on the theft being detected the girl had taken arsenic for fear of her father's anger ; she vomited during the flogging, and died in slight convulsions. Upon this Wildberg attributed death to the arsenic, and the father was discharged.

A man intending to commit suicide, took eleven grains of strychnine and then threw himself out of a window and sustained great bodily injury. The surgeon who examined him finding so much more spasm than could be accounted for by the violence sustained, discovered the facts of the case from the patient's confession. There was also evidence of the purchase of the poison.

The cause of death may be easily assigned in such cases when the circumstances are known; but without proper inquiry and great care in conducting examinations after death the apparent may be sometimes mistaken for the real cause.

An inquest was held on a young man who committed suicide by throwing himself from a window. He lived sufficiently long to inform his medical attendant that he had first taken corrosive sublimate, then cut open his wrist in order that he might bleed to death, and finding this ineffectual, had thrown himself from the window.

Even when there may be no suspicion of poisoning, it will be necessary to observe the state of the stomach and its contents—*i.e.*, to determine whether it contains food, the nature of the food, and the degree to which it has undergone digestion, for any of these matters may be incompatible with the evidence of witnesses.

In *R.* v. *Spicer*, the falsehood of one part of the prisoner's defence was made evident by an examination of the deceased's stomach. The deceased was found dead at the foot of a stair. The prisoner stated that *after* he and his wife had had dinner he heard a fall. The woman had died instantaneously, and the fall was heard by neighbours at or near the dinner-hour. The stomach was quite empty; there was no trace of food. It was therefore clear that this part of the prisoner's story was untrue, as, if the deceased had died immediately after dinner, some portion of undigested food would have been found in the stomach.

A wound may cause death either *directly* or *indirectly*. A wound operates as a *direct cause of death* when the wounded person dies either immediately or very soon after its infliction, and there is no other cause, internally or externally, to account for death. In wounds which cause death *indirectly*, it is assumed that the deceased survives for a certain period, and that the wound is followed by inflammation, septicæmia, toxæmia, tetanus, or some other mortal disease which is a consequence of the injury. Under this head may be also included all those cases which prove fatal by reason of surgical operations rendered imperatively necessary for the treatment of injuries, presuming that these operations have been performed with ordinary skill and care.

If a wounded person has been the subject of ill-treatment, and he subsequently dies, the question will arise as to what was the cause of death. In such cases the supervening disease, the poison, or the subsequent ill-treatment, should be of such a nature as to be a potential cause of *sudden or rapid death.* It would be no answer to a charge of death from violence to say that there were marks of chronic disease in the body, unless the disease was a potential cause of death under the symptoms which actually preceded death. In many cases where death supervenes upon wounding, and it is admitted that violence has been inflicted, but asserted that it was not the cause of death, the medical evidence may be decisive. Among numerous cases which have occurred in England, it has been found that the *latent causes of death* in wounded persons were chiefly inflammation of the thoracic or abdominal viscera, intracranial hæmorrhage, diseases of the heart and large blood-vessels, phthisis, ruptures of the stomach and bowels from disease, internal strangulation, and the rupture of deep-seated abscesses. In some of these cases the person was in a good state of health up to the time of the violence, and in others there was a slight indisposition. The history was nearly always the same; it was only by careful medical examination that the true cause of death was ascertained.

The master of a school is sometimes blamed when a boy dies soon after corporal punishment, and where there is no suggestion that an undue amount of violence has been used. In such cases the result is usually attributable to some unhealthy state of the body. When the disease which gives rise to doubt is seated in a part which is remote from that which sustained the violence, all that is required is that the examination of the body should be conducted with ordinary care. If the disease should happen to be in the part injured (the head or chest), the case may be more perplexing. The difficulty can then be solved only by carefully considering the ordinary consequences of such injuries. The violence may have been too slight to account for the diseased appearance; and the disease itself, although situated in the part injured, may be regarded as an unusual consequence of such an injury. On the other hand, the presence of chronic disease will afford no exculpation of acts of violence of this nature.

In some cases slight blows have been followed by fatal consequences even when no disease existed to account for the result.

The following possible causes of death must be considered :—

1. Death from hæmorrhage.
2. Death from gross injury to important organs.
3. Death from shock.
4. Death at a remote period—
    - From toxæmia.
    - From pathological changes arising from the wound.
    - From pre-existent disease.
    - From independent disease following injury.
5. Which of two or more wounds caused death ?

1. **Death from Hæmorrhage.** Loss of blood operates by producing fatal syncope. A quantity of blood escaping from a vessel, although insufficient to cause death by affecting the heart and circulation, may readily destroy life by disturbing the functions of the organ or part into which it is effused. Thus a small quantity effused into or upon the substance of the brain, or at its base, may prove fatal by compression; again, if, in a case of wounded throat, blood should flow into the windpipe, it may cause death by asphyxia—*i.e.*, by stopping the respiratory process. In these cases it is obvious that the blood acts mechanically; and in respect to the last condition a medical man, unless circumspection is used, may involve himself in a charge of malpraxis. In wounds of the chest, involving the heart and lungs, death is frequently due not so much to the actual quantity of blood effused as to the pressure which it produces upon these organs. Several ounces effused into the pericardium may arrest the action of the heart.

The absolute *quantity of blood* required to be lost in order to prove fatal varies according to numerous circumstances. The young, the aged, and those who are labouring under infirmity or disease, will perish from loss of blood sooner than others who are healthy and vigorous. Infants are liable to die from this cause as a result of slight wounds. Even the healthy and vigorous, when their vital powers have been depressed by maltreatment or by brutal violence, will sink under the loss of a comparatively small quantity of blood. Some persons have a predisposition to excessive bleeding from slight injuries ; and this condition is hereditary. The slightest wound or puncture may be attended with intractable bleeding which may lead to death. The principal cause of such bleeding is the presence of the disease known as **hæmophilia**, which is now well recognised, though its pathology is but ill understood. When a person bleeds to death from what would, in common circumstances, be a simple wound, the admission of this fact may in certain cases lessen the responsibility of an accused person.

A *sudden loss* of blood has a much more serious effect than the same quantity lost slowly. A person may fall into a fatal syncope from a quantity of blood lost in a few seconds which he would have been able to bear readily had it escaped slowly. This is the reason why the wound of an artery proves so much more rapidly fatal than that of a vein. Death speedily follows the wound of a large artery like the carotid ; but it takes place with equal certainty, although more slowly, from wounds of smaller arteries. In a case in which one of the intercostal arteries was wounded by a small shot, hæmorrhage caused death in thirty-eight hours, partly by direct loss of blood and partly by compression of the lung. Wounds of the anterior tibial and of the internal mammary arteries have also proved fatal. Wounds of large veins, such as the jugular, may, from the quantity of blood suddenly lost, speedily destroy life. If a wound is in a vascular part, although no vessel of any importance be divided, the person may die from bleeding.

It is difficult to say what quantity of blood must be lost in order that a wound may prove fatal. The whole quantity contained in the body of an adult is calculated at about one-twentieth of its weight. The loss of about two-fifths of the total blood is usually considered to be sufficient to prove fatal to adults. But while this may be near the truth, many persons will die from a much smaller quantity, the *rapidity* with which the effusion takes place having a considerable influence.

Internal Hæmorrhage. Hæmorrhage may prove fatal, although the blood does not visibly escape from the body. In incised wounds the flow externally is commonly abundant, but in contused, punctured, and gunshot wounds the effusion may take place internally and rapidly cause death. In severe contusions or contused wounds involving highly vascular parts, the effusion may go on to a fatal extent, either into the cavities of the body or throughout the adjacent loose cellular tissue. In death from severe flogging blood may be effused in large quantity beneath the skin and among the muscles ; this effusion will operate as fatally as if it had flowed from an open wound. Many pounds of blood may thus be effused. The most fatal internal hæmorrhages are those which follow ruptures of the organs from violence or disease. Ruptures of the heart, lungs, liver, spleen, and kidneys have thus caused death. These cases of ruptured internal organs and concealed hæmorrhages constitute a very difficult chapter of surgical diagnosis and treatment.

A man who had been run over was brought to hospital. He complained of pain in the back, but there were no symptoms of severe injury, and no marks of violence were seen on the skin of the back. He left the hospital and walked with some assistance to his house. A few hours afterwards he was found dead in bed. On inspection a large quantity of blood was found effused into the abdomen. This had proceeded from a kidney, which had been ruptured transversely through its whole substance.

In these cases the hæmorrhage may have temporarily ceased, when slight muscular exertion may have caused it to recommence and to lead to death.

The means of ascertaining whether a person has died from bleeding by an open wound are these : Unless the wound is situated in a vascular part, we shall find the vessel or vessels, from which the blood has issued, divided, the vessels empty, and the body more or less pallid, although this last condition is of course liable to be met with in certain cases of disease. The blood will commonly be found more or less clotted or coagulated on those surfaces on which it has fallen. If, with these signs, there is an absence of disease likely to prove rapidly fatal and no other probable cause of death is apparent, it may be fairly referred to loss of blood. This opinion may, however, be materially modified in reference to open wounds by the fact of the body not being seen on the spot where the injury was actually inflicted, by the wound having been sponged, the blood removed by washing, and all traces of bleeding being destroyed. In these circumstances, the case must in a great measure be made out by presumptive proof ; and here a medical witness may have the duty thrown upon him of examining articles of dress, furniture, or weapons, for marks or stains of blood.

It must not be supposed that all the blood met with round a wounded dead body, or in a cavity of the body, was actually effused during life. As soon as the heart's action ceases the arteries cease to spurt, but so long as the blood remains liquid—*i.e.*, from four to ten hours—it continues to drain from the divided vessels. The quantity thus lost, however, is not considerable, unless the veins implicated are large, or the part is highly vascular, *i.e.*, full of small vessels. In wounds involving the great vessels of the neck the quantity of blood which drains from the wounded part after death may be large. (*Vide* " *Post-mortem* Bleeding.").

2. **Death from Gross Mechanical Injury to a Vital Organ.** We have instances of this becoming a direct cause of death in the crushing of the heart, lungs, or brain, as in falls and in railway accidents. The severe mechanical injury is sometimes accompanied by a considerable effusion of blood, so that the person really dies from hæmorrhage ; in other instances the quantity of blood lost is inconsiderable, but the extensive damage to the tissues leads to shock.

3. **Death from Shock and Inhibition.** This is sometimes a direct cause of death under the infliction of external violence ; and in this case life is destroyed without the injury being sufficient to account for a result so speedily fatal. Whatever theory may be adopted to explain it, as from inhibition of the heart, dilation of splanchnic vessels, absorption of histamines from crushed tissues, etc., there is no doubt that a person may die from what is termed shock without any marks of severe injury being discovered. We have examples of this mode of death in motor and other accidents, in death from lightning, or from severe burns or scalds, in which the local injury is often far from sufficient to explain the rapidly fatal consequences. As instances of this form of death from violence may be also cited those cases in which a person has been suddenly killed by a blow on the upper part of the abdomen or on the pit of the stomach, which is supposed to operate by producing a fatal impression on the nerves and nerve ganglia. Whether this be or be not the true explanation, it is

admitted that a person may die from so simple a cause without any mark of a bruise externally, or physical injury internally, to account for death. It is probable that fatal inhibition of the cardiac and respiratory centres may occur after slight stimuli applied to certain parts, for example, a surgeon passing a catheter into the bladder or a sound into the uterus. It has also occurred from a slight blow on the testicles and similar minor injuries. Cardiac inhibition may occur from pressure on the carotid sinus. On the skin there may be some abrasion or slight discoloration; but, as it has been elsewhere stated (*infra*, "With what Instrument Inflicted"), these are neither constant nor necessary accompaniments of a blow. Convictions for manslaughter have taken place when death has been produced in these circumstances. Concussion of the brain, unattended by visible mechanical injury, furnishes another example of this kind of death. A man receives a severe blow on the head; he falls dead on the spot, or becomes senseless and dies in a few hours. On an inspection there may be merely the mark of a slight bruise on the scalp; in the brain there may be no rupture of vessels or laceration of substance, and all the other organs of the body are found healthy. In certain railway accidents persons have died in somewhat similar circumstances. There has been no physical indication of a mortal injury, and no cause apparent to account for death. This can be referred only to the shock or violent impression which the nervous system has sustained from the blow or violence. A medical witness must give his evidence with caution in such cases, since, in the defence, it is the custom to rely upon the absence of any visible *mortal* wound or physical injury to account for death as a proof that no injury was done.

Secondary shock may develop insidiously some hours after an injury, resulting from loss of blood volume, fatigue, dehydration, pain, exposure to cold and wet, etc. A person may have received *many injuries*, as by blows or stripes, not one of which, taken alone, could in medical language be termed mortal; and yet he may die directly from the effects of the violence either on the spot or very soon afterwards. At the trial of Governor Wall, the judge directed the jury that the long continuance and severity of pain (in flagellation) may be productive of as fatal consequences as if instruments or weapons of a destructive kind were used. It is not often that "scholastic flagellation" is a cause of death in Great Britain. One case, however, which excited public attention from the atrocity of the circumstances attending it, was the subject of a trial for manslaughter. (*R.* v. *Hopley*).

The evidence showed that the master had beaten a youth of sixteen very severely for nearly two hours with a rope and a stick. The external wounds were slight, but an inspection showed that the muscles as well as all the soft parts beneath the skin had been considerably bruised and lacerated, and that there were extensive effusions of blood in the cellular membrane of the arms and legs. There was no mortal wound in the common sense of the term, but there was no reasonable doubt that the boy had died from the violence inflicted on him by the master.

On a trial for murder, which took place in Germany, it was proved that the deceased had been attacked with sticks, and that afterwards he had been flogged on the back with willow switches. He died in about an hour. On inspection there was no mortal wound, and no injury to a vital organ; there were merely the marks of lacerations and bruises on the skin, apparently not sufficient to account for death; but this was, nevertheless, very properly ascribed to the violence.

The case of the Duchess of Praslin, who was murdered by her husband in Paris in 1847, furnishes an additional proof of the fatal effect produced by numerous injuries. On an inspection of the body it was found that on the head, neck, and both of the hands, there were no fewer than *thirty* distinct wounds, some contused, and other incised and punctured. There were also the marks of many bruises and the impression produced by the nails of the assailant's hand over the mouth. For the most part these injuries were slight, and not one could be said to be necessarily mortal. The most serious wound was situated on the right side of the neck; but even here the carotid artery and internal jugular vein had escaped injury. Death was referred to the loss of blood which had taken place from the numerous wounds inflicted during the struggle with the assassin.

In the absence of any large effusion of blood beneath the skin, death in such cases is sometimes referred to exhaustion, but this is only another mode of expression; the exhaustion is itself dependent on a fatal influence or impression produced on the nervous system.

With reference to the occasional cases where boxing contests have ended mortally, there are records that death has occurred on these occasions by three distinct methods: (1) by so-called exhaustion, the combined effect of many blows, with intense effort and excitement on the part of the deceased; (2) by gross injury—fractured skull, meningeal hæmorrhage, rupture of a viscus, etc.; (3) from the so-called "knock-out" blow on the point of the chin, which through shock produces temporary insensibility, but occasionally death, without any obvious mortal injury. A careful autopsy is the only means by which the nature of the death can be cleared up in such circumstances, and, in estimating the culpability of the opponent, due regard must be paid to any unsuspected pathological condition found, such as degenerate vessels, kidney disease, thinness of skull, enlarged heart, etc.

In addition to what is above referred to as a shock from what may be called physical causes, there is beyond any question a mental form of shock, for it is familiar to every one. Fainting from fright or from some unpleasant sight or smell is too common to need mention; but such "faint" may be a fatal one, and is a not very infrequent cause of sudden death in persons who, so far as a careful *post-mortem* examination can show, are in perfect health.

Some of these cases must be ascribed to "vagal inhibition" of the heart, others to effects on the vasomotor centre.

From these considerations, it cannot be expected that in every case of death from violence or maltreatment there must be some specific and visible *mortal injury*. When the circumstances accompanying death are unknown, a medical opinion should be expressed with caution; but if we are informed that the deceased was in ordinary health and vigour previous to the infliction of the violence, and there is no morbid cause to account for his *sudden* illness and death, there is no reason why we should hesitate in referring death to the effects of a number of injuries. Among non-medical persons a prejudice exists that no person can die from violence unless there be some distinctly *mortal* wound actually inflicted on the body, *i.e.*, a *visible* mechanical injury to some organ or vessel important to life. This is an erroneous notion, since death may take place from the disturbance of the functions of an organ important to life without this being necessarily accompanied by a perceptible alteration of structure. For further illustrative cases *vide* "Suicide."

4. **Wounds indirectly Fatal.** Certain kinds of injuries are not immediately followed by serious consequences; but a wounded person may die

after a long or shorter period, and his death may be as much a consequence of the injury as if it had taken place on the spot. The aggressor is as responsible as if the deceased had been directly killed by his violence provided the fatal result can be traced to the usual and probable consequences of the injury.

Death may follow a wound, and be a consequence of that wound, at almost any period after its infliction. It is necessary, however, in order to maintain a charge of homicide, that death should be strictly and clearly traceable to the injury. A doubt on this point must, of course, lead to an acquittal of the accused.

In England a person can be convicted of murder or manslaughter if the deceased was in a bad state of health when attacked and the jury are satisfied that the injuries inflicted by the accused accelerated the death.[1]

In *R.* v. *Hayward*[2] the prisoner was indicted for the manslaughter of his wife. From the evidence it appeared that the prisoner came home in a condition of violent excitement and expressed the determination of giving "her something" when she returned; that on her coming into the house there were sounds of an altercation; that the woman rushed from the house followed by the prisoner, who used violent threats towards her; that she fell into the roadway, and while lying there was kicked by the prisoner on the left forearm; and that when picked up she was dead. The medical evidence showed that the bruise on the arm could not have been the cause of death. The *post-mortem* examination showed that the deceased "was suffering from a persistent thymus gland, two inches wide and weighing one and three-quarter ounces, lying at the base of the heart. Such a state of affairs was proved to be quite abnormal at the deceased's age—22. The cause of death was given as cardiac inhibition, and the medical evidence was to the effect that in a person the subject of persistent thymus gland, such as the deceased, any combination of physical exertion and fright or strong emotion might occasion death in such a fashion. Counsel for the prisoner submitted that there was no case to go to a jury. But the judge held that there was sufficient evidence to support the charge of manslaughter if the jury believed it. No proof of actual physical violence was necessary, but death from fright alone, caused by an illegal act, such as threats of violence, would be sufficient. The abnormal state of the deceased's health did not affect the question whether the prisoner knew or did not know of it, if it were proved to the satisfaction of the jury that the death was accelerated by the prisoner's illegal act. The jury found the prisoner guilty, and he was sentenced to three months' imprisonment with hard labour.

It is the law of England that when a person dies from a wound the assailant shall not be adjudged guilty of homicide unless death takes place *within a year and a day* after the infliction of the wound.[3] (This does not apply in Scotland).

Many cases might be quoted in illustration of the length of time which may elapse before death takes place from certain kinds of injuries, the injured person having ultimately fallen a victim to indirect consequences thereof.

Wounds of the head are particularly liable to cause death insidiously. The wounded person may appear to be going on well, when, without any obvious cause, he suddenly expires. In general an examination of the body will suffice to determine whether death is to be attributed to the wound or not.

[1] *R.* v. *Martin*, 5 C. & P. 128; *R.* v. *Murton*, 3 F. & F. 492.

[2] 1908, 21 Cox, C. C. 692.

[3] *R.* v. *Dyson*, 1908, 2 K. B. 457.

In one case the metal portion of a penholder was found embedded in an abscess in the brain of a deceased man. The foreign body had been there upwards of twenty-five years, as the result of an accident when the deceased was a boy at school. No symptoms had been exhibited at the time, and none was exhibited subsequently until a few months before death.

In another case a man was shot in the left side of the chest, and the bullet remained lodged in the left lung during a period of *twenty-five years*. The bullet in penetrating had fractured the humerus at its neck, in consequence of which the upper extremity had been amputated at the shoulder-joint. The wound of the chest soon healed, but the patient remained during his life subject to fits of severe breathlessness and hæmoptysis, which eventually caused his death. On examination of the body the bullet was found lying behind the third intercostal space in the midst of the pulmonary tissue, but lodged in a cyst which communicated with the large air-tubes.

In severe injuries affecting the spinal cord or column, death is not an immediate consequence, unless that part of the organ which is above the origin of the phrenic nerves (supplying the diaphragm) is wounded. Injuries affecting the lower portion of the spinal column do not commonly prove fatal until after some days or weeks ; but the symptoms manifested by the patient during life, as well as the appearances observed in the body after death, will sufficiently connect the injury with that event.

Cases in which there has been damage to the lower part of the spinal cord may live several months, succumbing at length to septic cystitis, bedsores, etc.

In discussing the deaths of persons who have recovered from the immediate effects (hæmorrhage, shock, gross injury), we may for the sake of clearness, classify them into :—

(*A*) Cases in which the consequential sequence of events is direct and obvious, *e.g.*, septicæmia, tetanus, etc.

(*B*) Cases in which the wound produces a separate pathological lesion, which in turn proves fatal, *e.g.*, diaphragmatic hernia, aneurism, surgical operations, etc.

(*C*) Cases in which a definite pathological condition was present before the injury, *e.g.*, cysts or tumours in abdomen, or alcoholism.

(*D*) Cases in which a definite pathological condition of a totally different nature arose after the wounding, and the consequential sequence is doubtful, *e.g.*, tubercular meningitis after a blow.

(*A*) *Consequential sequences, direct and obvious.* These, again, must be divided into several groups.

1. The wound, which may not be dangerous in itself, allows the entrance of some infective microbe, which produces a general blood infection (septicæmia) or intoxication or both. This includes the ordinary forms of wound infections as well as less common infections such as tetanus, gas gangrene, anthrax, hydrophobia, glanders, etc.

2. The wound itself causes such destruction of tissue that gangrene may ensue and lead to the death of the victim, either with or without amputation. This group includes severe crushes by bruising of the limbs, with rupture of main vessels.

3. The wound is so severe as to set up inflammation of the underlying viscera (pleura, pericardium, peritoneum, lungs, etc.), or it ruptures a viscus (bladder, intestines, etc.), and so leads to severe illness and death.

4. The wound is in such a situation (severe cut throat, for example) that it cannot be kept aseptic, and secondary pneumonia directly develops from it.

The legal responsibility of an accused person for an event which depends only in an indirect manner on the injury originally inflicted by him is often difficult to determine. It is, however, impossible for the court to decide so difficult a question in the absence of satisfactory medical evidence, and a medical witness should fully understand the importance of the duty here required of him.

When blood infection can be directly traced to a wound, and when there is no other cause to which the state of the body can be attributed, it can scarcely be regarded by a medical practitioner as an unexpected and unusual consequence, especially when the injury is extensive, or seated in special parts of the body, such as in the scalp. If death takes place in these circumstances, the accused will be held as much responsible for the result as if the wound had proved directly mortal.

Tetanus is a disease due to the poison of a bacillus which, while remaining locally at the point of invasion, secretes a toxin which has a specific affinity for nervous tissue. It is a comparatively rare sequel to wounds in civil life, but is liable to occur even in slight wounds which have come in contact with the earth. The organism is most commonly found in horse manure, but it has also been found in the fæces of cows, sheep, dogs, etc.[1]

The bacillus occasionally enters the body through wounds which are unnoticed by the victim, and the disease is consequently, but erroneously, said to be spontaneous. In endeavouring to connect its appearance with a particular wound or personal injury, it will be proper to observe: (1) whether there were any symptoms indicative of it before the wounding; (2) whether any probable cause could have intervened to produce it between the time of its appearance and the time at which the violence was inflicted; (3) whether the deceased ever rallied from the effects of the violence.

The time at which tetanus usually makes its appearance, when it is the result of a wound, is from about the fifth to fourteenth day; but it may not appear for long periods after the injury, and after the wound has completely healed.

A medical practitioner is bound to exercise great caution before he pronounces an opinion that a fatal attack of tetanus has arisen either from so-called spontaneous causes or from slight blows or personal injuries inflicted by a second person.

A case occurred in St. Bartholomew's Hospital which illustrates the necessity for making a rigorous inquiry into all the attendant circumstances. A boy *æt.* 15, while quarrelling with another, received a blow in the back from his companion's fist, and this was followed by a kick which was not of a severe nature. He was able to get up and walk home; but in about two hours he complained of stiffness of the lower jaw. On the fourth day after the blow, he died from tetanus which had apparently resulted from the blow. It transpired, however, on inquiry, that six days previously to the first appearance of the tetanic symptoms the boy had accidentally driven a rusty nail into his foot, and that the suppurating wound which resulted from this injury had closed only on the day on which the blow was inflicted. On an examination of the body a small puckered cicatrix, such as would result from the healing of a punctured wound, was found on the ball of the great toe, and there could be no doubt from the circumstances that this, and not the slight blows struck by the assailant, had been the cause of the fatal attack of tetanus.

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[1] Kerrin, J. D., *Brit. Journ. Exp. Med.*, 10 : 370, 1929.

It is probable that many cases have been set down as idiopathic tetanus in which, by proper inquiry, the disease might have been traced to a concealed wound or some personal injury. In one instance the tetanus was at first considered to be idiopathic, but shortly before death a small black mark was observed on the thumb-nail. On making inquiry, it was found that a few days previous to the attack a splinter of wood had accidentally penetrated the thumb. The patient attached so little importance to the accident that he did not mention the circumstances to his medical attendant.

Many trials for wounding have occurred in this country in which tetanus was the immediate cause of death ; and the defence has generally rested upon the probable origin of the disease from accidental causes other than the wound, the subject of the charge.

Erysipelas, like tetanus, may be a fatal sequel to slight injuries. Wounds affecting the scalp are liable to be followed by this disease. Burns and scalds may prove fatal either through tetanus or erysipelas as a secondary cause. Some persons are particularly prone to erysipelatous inflammation, and thus wounds, comparatively slight, may have a fatal termination. On these occasions, in order to make an assailant responsible for the fatal result, the erysipelas must be clearly traced to the injury. The medical facts that the person assaulted has never recovered from the effects of the violence, and that the inflammation set up has suddenly assumed an erysipelatous character, are sufficient to establish this connection. If there has been recovery, and an interval of some days has elapsed, a doubt may arise respecting the connection of the erysipelas with the violence inflicted. This disease is said to be frequently idiopathic, *i.e.*, it appears like tetanus without any *obvious* wound. It is sometimes difficult to establish the connection of *erysipelas* with a wound, especially when the disease occurs in a remote part of the body not implicated in the wound. When this cannot be distinctly made out, the accused is usually acquitted.

The wounded person may **by his own fault** cause an otherwise simple wound to become fatal. A man who has been severly wounded during a quarrel may obstinately refuse medical assistance, or he may insist upon acting in a manner contrary to the advice of his medical attendant ; or by other imprudent practices he may prevent his recovery. In the case of the notorious Governor Wall, who was convicted of causing the death of a man by excessive punishment, it was attempted to be shown in evidence that the deceased had taken his own life by the immoderate use of spirits while under treatment in the hospital. In charging the jury, the Judge said that no man would be justified in placing another in so perilous a predicament as to make the preservation of his life depend merely on his own prudence. Neglect to call in a medical practitioner, or refusal to receive medical advice, will not always be considered as a mitigatory circumstance in favour of the accused, even though the wound were orginally capable of being cured. **Refusal of medical advice or treatment** does not always operate as a mitigatory circumstance on the part of an assailant, because a wounded person is not compelled to call for medical assistance, or to submit to an operation. A medical witness may not be in a condition to swear that an operation would have saved the life of the victim ; he may merely affirm that it might have afforded him a better prospect of recovery. Where a person has received a blow on the head, producing a depressed fracture, and symptoms of compression of the brain, a surgeon may propose an operation to elevate or to remove the depressed bone, but the friends of the patient may not permit the operation to be performed. In such a case the surgeon should state the facts to the court, and it is probable that in the event of conviction there would be some mitigation of punishment, because such an injury if left to itself, would usually prove mortal, and no doubt could exist in the mind of any surgeon as to the necessity for the operation. But the negligence or improper conduct of a person who receives a wound thus rendered fatal, does not always exculpate the aggressor. Each case must be judged on its own merits

Verdicts of manslaughter on the ground of negligence in cases where children have died without proper medical attention have been found against parents and guardians who are adherents of a "faith-healing" sect (*vide* "Quackery" and Children and Young Persons Acts, 1935 and 1938).

(*B*) *The wound produces a pathological condition, which in turn is the proximate cause of death.* It is difficult, if not impossible, to draw a hard and fast line between this group and the preceding; but there are several cases recorded, such as the following :—

In a case of intestinal obstruction, it was found on operation to be due to a diaphragmatic hernia. The patient died, and a scar was found in the diaphragm, though the yielding of which the hernia had occurred. Inquiry showed that some two years previously the patient had been stabbed through the diaphragm : the assailant was insane and was at the time of the death in Broadmoor Criminal Lunatic Asylum, so that no further steps were taken. A similar case is reported in former editions of this work, and many others may be found in medical literature.

A boy died from gastric ulcer and intestinal obstruction, which on *post-mortem* examination was clearly traceable to stricture and ulcer produced by corrosive poison swallowed six months previously. The act was suicidal, but if it had been homicidal there could have been no doubt as to the cause of the death or the responsibility for it.

Cases of stricture thus produced are not very uncommon, nor are cases where an abscess forms, remains for a long time quiescent, and then suddenly becomes active and leads to the death of the patient.

In *R.* v. *Hynes*, it was proved that the prisoner had inflicted severe wounds on the head of the deceased, and the death took place two months afterwards. The medical witnesses were perfectly agreed that death was caused by an abscess in the brain as a result of these wounds. The jury had great difficulty in finding a verdict of guilty, because in their opinion too long a time had elapsed for the injuries to have been the cause of death.

When a person is charged with having caused the death of another through violence terminating in some fatal disease, the case often admits of a skilful defence, and this in proportion to the length of time after the violence of which the deceased dies. It may be urged that the disease is liable to appear in all persons, even the most healthy ; or it may arise from causes unconnected with the violence. It must be remembered that death cannot be proved to have been indirectly a consequence of the wound unless it can be shown that the disease or other condition could not have arisen except through the agency of that injury.

Surgical Operations. Apart from the question of simple negligence (*vide* Section " Malpraxis "), the question of the effect of an operation must be considered. A surgical operation is frequently resorted to in the treatment of wounds, and a wounded person may die either during the performance of an operation or in consequence thereof. A question may thus arise, whether the person who inflicted the wound should be held responsible for the fatal result. The law of England regards a surgical operation as part of the treatment, and if undertaken *bonâ fide* and performed with reasonable care and skill, the person who caused the wound will be held responsible, whatever may be the result. The necessity for an operation, and the mode of performing it, will be left to the operator's judgment. As the defence may turn upon the operation having been performed unnecessarily, and in an unskilful manner, it will be right for a medical practitioner, if possible, to defer it until he has had the advice and assistance of other practitioners. According to Lord Hale, if death takes place from an unskilful operation, performed for the cure of a wound, and not from the wound, the responsibility of the person who caused the wound ceases.

Death is by no means an unusual result of severe operations, however skilfully they have been performed. Death may occur on the table from respiratory or cardiac failure, or from shock. A patient may succumb in a short time from ileus, from secondary hæmorrhage, from thrombosis, from pulmonary embolism, from massive collapse of the lung, from broncho-pneumonia or from any type of infection. Delayed chloroform poisoning may occur after severe operations. Inspection of the body after death frequently reveals the signs of chronic disease, which had not previously been noticed, and which might have remained quiet for years had no extraordinary call been made upon the system.

If an operation were performed unnecessarily or unskilfully, the responsibility of an aggressor would possibly cease, if the death of a wounded party could be clearly traced to the operation. The aggressor will be held responsible if the original wound were likely to produce death, although it may be unskilfully treated subsequently. If, notwithstanding the fact that the operation is performed with ordinary care or skill, the wound becomes septic, and the victim dies, the aggressor will be liable for the consequences. The practice of the law is strictly consistent with justice. If an operation be considered necessary for the treatment of a wound, which would probably prove mortal without it, and if the operation be performed with ordinary skill, and death nevertheless ensues as a direct or indirect consequence, it is only just that the person who inflicted the injury should be held responsible for the result. It is presumed in these cases that, if the patient were left to himself, he would, in all probability, die from the effects of the wound. If, therefore, the surgeon knew that an operation would give the victim a chance of life, and if he did not perform the operation, it is sometimes contended that the deceased died, not from the wound, but from the neglect of his medical attendant.

In an Irish case the deceased received a pistol shot wound at the back of his neck, and died from the effects some days later. The bullet fractured and splintered the atlas, wounding and crushing the soft parts of the neck, and leading to the formation of an abscess in this part. The actual cause of death was inflammation of the spinal cord and its membranes. The surgeon considered it necessary to enlarge the wound for the purpose of removing the bullet, which was then supposed to be lying within reach. In this operation a small artery (the occipital) was divided, but the quantity of blood lost was small; the bleeding was stopped by compression, and this bleeding did not contribute to the cause of death. The defence was that the wound would not have proved fatal but for incompetent surgical treatment; that the probing of the wound was unnecessary, and that it was unskilfully performed. There was evidence by experts on both sides. From the facts proved, apart from the opinions expressed, there was no reasonable doubt that the case had been treated with *bonâ fides* and with competent skill. The prisoner was positively identified by the deceased and others, and yet upon this evidence the jury returned a verdict of "not guilty".

The evidence of surgical experts showed that the probing operation performed on the deceased was in strict accordance with the rules of surgery and that the wound was of such a nature as from the first to be likely to prove mortal in spite of treatment. Subsequently to the trial nine eminent London surgeons agreed that the bullet-wound in the neck was the direct and sole cause of death, and that no blame could be justly assigned to any of those by whom the wound was treated.

It is interesting to compare the above case tried in 1871 with a case recently reported[1] in which a surgeon and radiographer were prosecuted for negligence for failure to operate on a man who had been shot in the right side of the back just above the hip. It was contended that a mistake in locating the position of the bullet and consequent failure to operate had led to the death of the injured man, and this contention was upheld by the courts.

According to the law of England, if a man unlawfully inflicts a dangerous wound on another, and after being treated by qualified medical practitioners, acting *bonâ fide*, and applying themselves with the best of their ability to the case, the wounded person dies of the wound, the aggressor is guilty of homicide, even although an erroneous treatment of the case by the medical practitioner may have been the cause of death.

From decided cases it would appear that where death ensued upon a surgical operation the law has regard to three circumstances: (1) the necessity for the operation itself, (2) the competency of the surgeon, and (3) the fact that the wound was dangerous and would be likely to prove mortal in any event.

In *R.* v. *Draper*, the accused so carelessly drove a waggon, that he knocked down the deceased, and a wheel passed over his left arm just above the elbow. The deceased was taken to the Royal Free Hospital, when it was proposed at once to amputate the arm, but he, after consulting with his friends, refused to submit to the operation. The arm was then dressed and put into splints, and the man was told that his life would be endangered if he did not permit his arm to be amputated. A week later he consented to the operation. The arm was removed, but he died of pyæmia, one of the secondary consequences of the operation. In the opinion of the medical officers of the hospital, the man's life would have been saved if he had allowed immediate amputation.

The judge directed the jury to put out of their minds the question whether death had ensued from the refusal of the deceased to have his arm amputated, as that was a matter of law, and that the question for them to consider was whether, owing to the negligence of the accused, the deceased sustained the injury which led to his death. The jury found the accused guilty.

Competence for forming a judgment, or for undertaking an operation, means the possession of that average skill and experience which every legally qualified medical practitioner is presumed by law to possess.

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[1] J. Amer. Med. Ass., 120 : 1245, 1942.

Exceptional cases occur where death results directly from the medical treatment; but these are reducible to two classes: (1) when the wound is *not* in itself *mortal*, and the treatment causes the death; and (2) when the death is clearly caused by the *treatment*, either by reason of its being *unskilful* or not being necessary to save life.

Operations not necessary to save life. Where the wounding is not mortal and an operation is performed under the mistaken view that it was necessary in order to save the victim's life and death ensues, it would doubtless be asserted by the defence that the victim would have recovered if the operation had not been performed.

Lieutenant Seton was killed in the Gosport duel case (*R.* v. *Pym*).[1] A tumour formed in the wound received by the deceased at the lower part of the abdomen; and this was believed by the three surgeons in attendance on the deceased to be an aneurismal enlargement from a wound in, or injury to, the femoral artery, for which it was considered necessary to tie the external iliac artery. The deceased died from peritoneal inflammation following an operation; and on inspection it was found that the tumour was formed by a mass of coagulated blood poured out, not from the femoral artery, but from one of its superficial and anomalous branches, which was divided about an inch below Poupart's ligament, and an inch from the main body of the artery. There was some difference of opinion about the necessity for the operation, both as to the time selected for its performance and as to its being absolutely requisite for the saving of life. In his evidence, Liston stated that the "tying of the iliac artery was necessary, and that no other operation would have been prudent." It was proposed to cross-examine the medical witnesses in order to show that the wound was not dangerous to life, and the operation not absolutely necessary. The Judge ruled that if a dangerous wound is caused, and the best advice is taken, and under that advice an operation is performed which is the *immediate* cause of death, the party who caused the wound is criminally responsible.

The question was subsequently raised at the trial of the principal in a duel and the prisoner was acquitted. This decision leaves undecided the question whether the operation was or was not necessary to save life.

A similar point arose in *R.* v. *Mc Intyre*,[2] where the prisoner was tried for the manslaughter of his wife by kicking her. The surgeon who attended the woman said that she had died from kicks. In cross-examination he stated that he fancied that a portion of the brandy—given by him to restore her—"had gone the wrong way into her lungs," and that death might have occurred in consequence. He further said that the woman's power of swallowing had been affected by her state of weakness, but in his opinion her death was caused by the blows which she had received, and that these had produced a general shock to the system and great loss of blood.

The Judge addressed the jury in these words. "Are you of opinion that she received mortal injuries before the surgeon was called in? If you are of opinion there was no mortal injury before, then you will find the prisoner guilty of an assault only." The jury returned a verdict of manslaughter.

R. v. *Fueling* involved some of the points here raised.

The deceased had been kicked severely on the right knee, but was able with much difficulty to walk home. Disease set in, and about ten months after the injury the leg was amputated. Ulceration of the stump ensued, and the deceased died from secondary hæmorrhage. There was much disease about the leg. The prosecution alleged that, notwithstanding the long period which had elapsed, the deceased had died from the unlawful act of the prisoner. The defence was that the deceased had died from an operation which was not necessary to the treatment.

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[1] 1 Cox, C. C. 339.

[2] 2 Cox, C. C. 379.

In addressing the jury, the Judge said that if a man attacked another and certain results ensued, in the course of which the qualified and competent medical adviser called in took, in his discretion, a step the termination of which was unsuccessful, and which, perhaps, in the exercise of superior skill would not have been adopted, that termination would not save the man by whom the injury was inflicted from the consequences of his act. The jury had nothing to do with the question whether or not the offender contemplated the result of his act. The prisoner was acquitted.

In a recent case at Shrewsbury Assizes, the Judge said that the guilt of the assailant was not affected by any question whether if greater medical skill had been applied the victim might have survived.[1]

In *R.* v. *Davis and Wagstaffe* the prisoners were tried for manslaughter of a man who died during a " street fight." The victim's jaw was broken in two places, and on the following day he went into a hospital. The surgeon in charge decided that it was necessary to wire the jaw. The victim died during the administration of the anæsthetic. A *post-mortem* examination disclosed a serious injury to the trachea, which was due to the blow received. There was also tubercular disease of both lungs. In his evidence the surgeon stated : " I think death was due to a complication of causes : the results of the fracture of the jaw allowed the trachea to fall down when the man was under chloroform and allowed the tongue to fall back, and probably the tubercle in the lungs prevented us from restoring him as we should have done : the other cause was the chloroform, of course : the left vocal cord of the larynx was open and would impede respiration : it would be very difficult to say whether the injury to the trachea was a primary or secondary cause of death."

In charging the jury, the Judge said that the case must be dealt with according to the strict rule of law, which was that if, although there might be no intent to do more than assault, an injury was inflicted by one man on another which compelled the injured man to take medical advice, and death ensued from an operation advised by the medical man, the assailant was in the eye of the law responsible for that death. The injury to the jaw made it necessary to resort to the hospital ; competent medical men decided to perform an operation ; that rendered chloroform necessary ; and if under chloroform the man died, the rule of law was that the death could be traced back to the man by whom the injury had been done.

Medical Responsibility in reference to the Administration of Anæsthetics
In a large number of operations it is the general practice to administer chloroform or ether vapour or other anæsthetic. In spite of care on the part of the operator, the patient may die either before the operation is commenced or during its performance. The facts may leave no doubt that the wounded person died from the anæsthetic and not from the wound or operation. (See "Administration of Anæsthetics.").

(*C*) *Disease Local or General prior to the Injury.* It is by no means unusual for a person who has received a wound, or sustained some personal injury, to die from natural causes which were latent before the injury ;

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[1] *B. M. J.*, 1936, II : 201.

and as, in the minds of non-medical persons, death may appear to be a direct result of the injury, the case can be cleared up only by the assistance of a medical practitioner. Such a coincidence has been observed in many instances of attempted suicide. A man may have severely wounded himself while suffering from disease, or some morbid change tending to cause death may have occurred subsequently to the infliction of a wound, and death ensues. Without a careful examination of the body it is impossible to refer death to the real cause. The importance of an accurate discrimination in a case in which wounds or personal injuries have been caused by another must be obvious. A hasty opinion may involve the accused in a charge of manslaughter ; and although it may be possible to show at the trial that death was probably attributable not to the wound, but to co-existing disease, one result of the evidence of a medical witness given before a coroner or magistrate may be that the person charged is imprisoned for some months before the trial.

A natural cause of death may be present at the time that a wound is criminally inflicted, and a close attention to the symptoms preceding and the appearances after death alone can enable a surgeon to determine the real cause. A man may be severely wounded, and yet death may take place from rupture of the heart, the bursting of an aneurism, from apoplexy, phthisis, or other morbid cause which it here unnecessary to specify. If death can be clearly traced to any one of these diseases the aggressor cannot be convicted of homicide, for the medical witness may give his opinion that death would have taken place about the same time and in the same circumstances whether the wound had been inflicted or not.

The disease may be local, in which case it is easily discoverable by a skilled pathologist, or there may be a general constitutional state which predisposes to sudden death.

Local Disease Co-existent with Injury. A man otherwise healthy who suffers from a rupture may receive a blow on the groin, attended with laceration of the intestine, gangrene and death ; another with a calculus in the kidney may be struck in the loins and die, in consequence of the calculus perforating the blood vessels and causing fatal bleeding or subsequent inflammation. A cyst of the liver has thus been ruptured, causing fatal peritonitis.

In these cases the effects of the violence must be regarded as something unexpected ; it would not have produced serious mischief in a healthy person, and hence the responsibility of an assailant becomes much diminished. The crime is undoubtedly homicide, but the punishment may be of a lenient description.

On the other hand, there can be no absolute contention that a man is bound to have his body in so sound and healthy a state as to justify an unauthorised assault upon him. A man therefore, who commits an unauthorised assault upon his fellow-man must take the risk of the effects which such an assault may produce.

In *R.* v. *Wallis*, old-standing valvular disease of the heart was present in an elderly woman who had been severely maltreated, and the heart disease had caused severe symptoms long before the assault. For the defence it was urged that if in any case the cause of death be partly attributable to injuries and partly to natural and other causes, the accused is entitled to an acquittal. It was held that there could be no doubt that but for the injuries inflicted the woman would not have died ; therefore the act of the accused was the moving cause of her death. In cases of a mixed nature probably the best test is to determine the extent to which the alleged violence, when not of a definitely mortal nature, contributes to the death of a wounded person. In cases of this description the question is whether the violence, although not the immediate, was the accelerating cause of death.

There are numerous internal diseases, such as aneurism and various morbid affections of the heart and brain, which are liable to be rendered fatal by *slight* external violence; for example, an aneurism has burst *after* a slight blow on the back; fatty degeneration of the heart also has caused death after a slight blow.

In *R.* v. *Louisa J. Taylor* it was held by Lord Hale that the law applicable to these cases is as follows :—

> "It is sufficient to prove that the death of a person was accelerated by the malicious act of the prisoner, although the former laboured under a mortal disease at the time of the act. In these cases in which a slight degree of violence had been followed by fatal consequences, it is for a jury to decide, under all the circumstances, upon the actual and specific intention of the prisoner at the time of the act which occasioned death. In most of these cases there is an absence of intention to destroy life, but the nature of the wound, as well as the means by which it was inflicted, will often suffice to show the intention of the prisoner. An accurate description of the injury, if slight, may afford strong evidence in favour of the accused, since the law does not so much regard the means used by him to perpetrate the violence *as the actual intention to kill*, or to do great bodily harm. Serious injury, causing death by secondary consequences, will admit of no exculpation when an assailant was aware, or ought to have been aware, of the condition of the person whom he struck. Thus if a person notoriously ill, or a woman while pregnant, be maltreated, and death ensue from a secondary cause, the assailant will be held responsible, because he ought to have known that violence of any kind to a person so situated must be attended with dangerous consequences. So if the person maltreated be an infant or a decrepit old man, or one labouring under a mortal disease, it is notorious that a comparatively slight degree of violence will destroy life in these cases, and the prisoner would properly be held responsible. A wound which *accelerates* death, *causes* death, and may therefore render the aggressor responsible for murder or manslaughter, according to the circumstances."

General Conditions of the Body aggravating the Injury. When, owing to the person being in an unhealthy condition at the time of the infliction of simple fractures, or slight wounds (which in a healthy person would have a favourable termination), these are followed by infection proving fatal, the responsibility of an assailant for the death may become reduced. The consequence may be, medically speaking unusual or unexpected, and, but for the circumstances wholly independent of the act of the accused, would not have been likely to destroy life. In general, in the absence of malice, this appears to be the point to which the law closely looks, in order to make out the responsibility of the accused, namely, that the fatal secondary cause must be something not unusual or unexpected as a consequence of this particular injury. The medico-legal question presents itself under this form : Would the same amount of injury be likely to cause death in a person of ordinary health and vigour ?

Again, if the victim's constitution has been broken by dissipated habits, a wound which otherwise would probably have been of no consequence may easily become fatal ; or, on the other hand, the wound and its attendant troubles may be the exciting cause of a fatal attack of delirium tremens, this being a disease which occasionally presents itself as a secondary consequence of injuries to persons of intemperate habits.

Whether the injury is slight or severe the disease may equally supervene and may prove fatal. It is observed occasionally as a consequence of operations required for the treatment of wounded persons.

In some persons all the bones of the body are unusually *brittle*, so that they are fractured by the slightest force. Inflammation, gangrene, and death may follow when no considerable violence has been used ; but these being unexpected consequences, and depending on an abnormal condition of parts unknown to the assailant, his responsibility may not, *cœteris paribus*, be as great as in other circumstances. This condition of the bones can be determined only by a medical examination. Facts of this kind can show that the degree of violence used in an assault cannot always be measured by the effects unless a careful examination of the injured part is previously made. (*Vide* also p. 294).

(*D*) *A specific disease apparently unconnected with the wound arises subsequently to it.*

Cases of this kind are likely to cause great difficulty in interpretation. For example, after violence to the head without obvious physical damage, meningitis may supervene. This may not become clinically obvious for two or three weeks or it may be retarded for an indefinite period. Similarly a schoolboy may have his ears boxed by a master and may subsequently complain of pain in the head and may die within a week or two. At the autopsy meningitis may be found and the question arises whether it is due to the blow or not. If the meningitis is due to ordinary septic organisms, an effort should be made to ascertain where the septic process began, for it is possible that a quiescent middle ear or antrum infection may have been lit up by the violence. Even if tuberculous meningitis is found it is still possible that the injury may have initiated the disease, although in such cases it is highly probable that another focus of tuberculosis will be found in the body. An injury to any part of the body may lead to a lowered resistance at that part and this may predispose to the lodgment of bacteria at that site and the subsequent onset of disease. The fact that no evidence of injury may be found at the alleged site leads naturally to differences of opinion about the relationship of the trauma to the subsequent disease. In such cases the injury must be proved and if the symptoms of disease such as tuberculosis appear in a reasonable time in a previously healthy person there is a presumption that the injury may have been the causal factor. May [1] reports the case of a healthy boy who received an injury to his buttock who developed pulmonary tuberculosis and died about two years later. The history, from the accident to the death, supported the assumption that the accident was the cause of the infection.

WHICH OF TWO WOUNDS CAUSED DEATH ?

It is possible that a man may receive *two wounds* at different times and from different persons, and die after receiving the second ; in such a case, the course of justice may require that a medical witness should state which wound was the cause of death. Let us take the following illustration :—

> During a quarrel a man receives a gunshot wound in the shoulder. He is going on well with a prospect of recovery, when in another quarrel he receives a severe penetrating wound in the chest or abdomen from another person, and, after lingering under the effects of these wounds for a longer or shorter period, he dies.

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[1] May, Otto, *B.M.J.*, 2 : 1090, 1928.

If the gunshot wound were clearly shown to have been the cause of death, the second prisoner could not be convicted of homicide ; or if the stab were evidently the cause of death, the first prisoner would be acquitted on a similar charge. It might be possible for a surgeon to decide the question summarily, when, for instance, death speedily follows the second wound, and on inspection of the body the heart or a large vessel is discovered to have been penetrated ; on the other hand, extensive sloughing, sufficient to account for death, may take place from the gunshot wound, and on inspection the stab may be found to be of a slight nature, and not involving any vital parts. In both of these cases all would depend upon the judgment of the medical practitioner ; his evidence would be so important that no correct decision could be arrived at without it.

On some occasions, however, death may appear to be equally a consequence of either (or both) of the wounds, in which case probably both parties would be liable to a charge of homicide. The second wound, which is here supposed to have been the act of another, may have been inflicted by a wounded person on himself, in an attempt at suicide, or it may have had an accidental origin. The witness would then have to determine whether the wounded person died from the second wound or from that which he had received previously.

It is sometimes difficult to decide on the relative degree of mortality of several wounds, and on the share which they respectively have had in causing death. By a wound being of itself *mortal* we are to understand that it is capable of causing the death directly or indirectly, in spite of medical assistance. It must be assumed that the body is healthy, and that no cause has intervened to bring about or accelerate a fatal result. If when a person is wounded in a vital part he is labouring under disease, this fact will not throw any doubt upon the fatal nature of such a wound, and of its having caused death. If there should be more wounds than one, it is easy to say, from the nature of the parts affected, which was likely to have led to a fatal result. In order to determine, on medical grounds, whether a wound was or was not mortal, we may ask ourselves this question : Would the deceased have been likely to die at the same time, and in the same circumstances, if he had not received the wound ? There can obviously be no general rule for determining the mortal nature of wounds. Each case must be judged by the circumstances which attend it. The *effect* of the wound and the *intent* with which it was inflicted must be considered : its anatomical relations, which must depend on pure accident, are never interpreted in the prisoner's favour.

Further remarks on this matter will be found on p. 329, where suicide *v.* homicide is discussed.

WHEN WAS THIS WOUND OR BRUISE INFLICTED ?[1]

This question may arise when the accused asserts that a wound, either on himself or his victim, was caused in an innocent way on a date that does not agree with the theory of the prosecution as to how or when it arose. It cannot be definitely answered, but a medical witness is expected to be able to say whether the state of the wound is consistent with the sworn facts as to time, making allowance for the exceptions with which experience has made him familiar.

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[1] *Vide* also p. 103, where the age of a scar is considered.

When a part of the body is injured certain chemical and physical changes occur as a result of which capillary dilation and œdema develop almost at once. This is followed by the migration of white cells from the capillaries into the damaged area and if the part can be microscopically examined the white cells may be seen clinging to the wall of the vessels prior to migration within a few minutes. They then migrate in increasing numbers, a phenomenon which can be seen quite well microscopically within thirty minutes [1] but which no doubt is a continuing process from the moment of damage. The amount of exudation and infiltration depends on the extent of tissue damage. In the early stages the white cells of the extravasated blood must be distinguished from migratory cells. These polymorphonuclear leucocytes begin to fragment in three to five hours, a process of degeneration which is usually complete within twenty-one hours.[2]

In a clean wound the process of repair is seen in a few hours when the fibroblasts begin to proliferate and budding of loops from the capillaries with the formation of granulation tissue occurs. If the edges of the wounds are in apposition they become glued together by fibrin and healing occurs without the formation of granulation tissue.

So much depends on the nature of the wound and the instrument producing it that exact determination of the age of a wound is impossible, but it may be said that small clean wounds will scab over in from ten to twenty-four hours ; signs of inflammation in such as are infected will be apparent in from twenty to forty hours after infliction, and towards the later limit pus will be evident ; granulation tissue of appreciable extent will rarely be seen within a week. When once suppuration has been established in a wound, the wound may keep on suppurating for an indefinite time without much sign of healing ; in such a case, therefore, the limits will have to be so wide that they may be useless for medico-legal purposes. If parts of it show signs of scarring, a narrower limit may be fixed. It must not be forgotten that in cases of lowered vitality, in certain endocrine disturbances and in deficiency diseases, healing of wounds may be greatly delayed.

In bodies long dead, there may be some difficulty in distinguishing the effects of gangrene in a wound from those of putrefaction. Gangrene implies the death of a part in the living body, and putrefactive changes take place in the dead part, as in the entire dead body. If changes resembling those of gangrene are found in a wounded limb, while the rest of the body is not in a putrescent state, there may be some reason for the opinion that there was gangrene during life. In such a case, however, due allowance should be made for the more rapid decomposition of wounded parts. If putrefaction is advanced, the opinion of a person who has not seen the deceased while living can be little more than a conjecture.

The answer to the question in the case of a **bruise** must be given also with some caution. The changes which take place in the colour of a bruised spot will serve to aid the witness in giving an opinion on the probable time at which a contusion has been inflicted. After a certain period, commonly in eighteen or twenty-four hours, the blue or livid margin of the spot is observed to become lighter ; it acquires a violet tint.

[1] Carscaddon, W. J., *Arch. Path. & Lab. Med.*, 4 . 329, 1927.

[2] Higgins, G. M. & Palmer, B. M., *Arch. Path.*, 7 : 63, 1929.

and before its final disappearance it passes successively through shades of a green, yellow, and lemon colour. During this time the spot is increased in extent, but the central portion of the bruise which received the violence is always darker than the circumference. These changes are due to changes in and absorption of the blood pigment. The colour is finally removed by the absorption of the effused blood. The extent and situation of the bruise, the degree of violence by which it has been produced, as well as the age and state of health of the persons, are so many circumstances which may influence the progress of these changes. Thus a bruise is longer in disappearing in the old than in the young. Watson found effused blood in a bruise in an old person five weeks after the infliction of the injury. Where the membrane, beneath which the blood is effused, is dense, the bruise, *cœteris paribus*, is not so rapidly apparent to the eye, as the blood has to travel farther to reach the skin surface; nor, when formed, do the above changes take place in it so speedily as when the blood is effused into a loose subcutaneous tissue like that surrounding the eye or existing in the scrotum. In some instances a bruise has been observed to disappear without undergoing changes of colour at its margin. On examining a bruised portion of skin which has suffered from a severe contusion we find that the discoloration affects more or less the whole substance of the true skin, as well as the tissues beneath it.

These remarks in general hold good for superficial bruises where there is no great quantity of blood poured out; if, on the other hand, there has been a copious outflow of blood which has been able to coagulate into a clot of some size, absorption of the clot with a *restitutio ad integrum* of the affected tissues is a process of very uncertain duration.

An autopsy was performed on a man somewhat advanced in years, who four weeks previously had broken a bone in his leg; the ends of the broken bone were quite smoothed off by absorption, but round them was a large, still apparently quite recent, clot of blood. It was impossible to state the date of the fracture, even approximately, from the condition of the blood clot; the smoothness of the broken ends of the bone strongly suggested a probable duration of at least two or three weeks, but there was no callus.

Intact red cells have been found in bruises after several weeks, but it is obviously impossible to tell whether such cells are the product of the original injury or whether they are due to a subsequent secondary hæmorrhage. Hæmosiderin may be found in and about a bruise and in the adjacent lymph glands soon after its infliction and its presence gives us little definite information about its age. It is probably safe to say that it is not usual to find this iron containing pigment in less than twelve to twenty-four hours. Hæmatoidin, an iron free compound derived from blood, may be seen in the form of needle-like crystals in old bruises. It is unlikely to be found in less than a week.[1]

In **fractures of bones** it is usual to find the firm hæmatoma surrounding the broken ends of the bones showing signs of organisation in about forty-eight hours, the formation of osteoid matrix in about three days, and its transformation into callus starting about the end of the first week. Callus formation is well advanced in ten or twelve days. Callus is the cementing material thrown out between the ends of a broken bone, which gradually changes into bone; if then callus is felt the fracture is probably of this duration at least, but if none is found it is impossible to state in the living what is the age of a fracture. If callus is present, we may form some idea of the age of a fracture by the hardness and firmness of this substance; six weeks to two months is the average period for it to undergo a complete conversion into material as hard as bone. Callus may remain for long periods in certain cases, and this may cause difficulty in estimating the age of a fracture (Fig. 22). Once a fracture has acquired genuine bony union, there is no possible chance of ascertaining its age. In all cases, however, an X-ray examination of the bone, and where possible a microscopic examination of sections of the tissues should be made.

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[1] Muir, R. & Niven, J., *Jour. Path. & Bact.*, 41: 183, 1935.

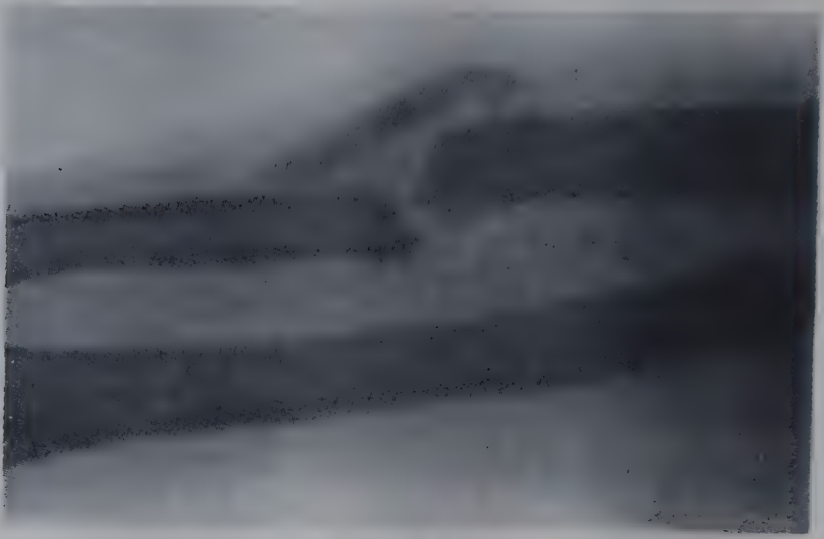

Fig. 22.
Fracture of the ulnar bone four months old, showing the presence of callus. Note the rounded ends of both fragments, indicating that the fracture is not recent.

In **dislocations** the only chance of estimating their age is the possible presence of a bruise, the colour of which may give some indication. This is a comparatively slight chance, and if the blood has escaped very deeply amongst the tissues it may not come to the surface for a long time, and give therefore a false estimate of the date of the injury. In older cases the amount of new fibrous tissue or the formation of a false joint may give some indication of the age of the injury.

WITH WHAT WEAPON, OR HOW, WAS THE INJURY INFLICTED ?

A. Evidence from the Wound itself

It is not necessary to prove that a weapon has been used for the production of a wound, for the words of the statute are: "Whosoever shall, *by any means whatsoever*, wound or cause any grievous bodily harm to a person," etc.; yet evidence of the use of a weapon in case of assault may materially affect the amount of punishment awarded on conviction. When, upon the clearest evidence, it is certain that a weapon has been used, it is not unusual for the accused to allege that no weapon was employed, but that the wound had been occasioned by an accident. A medical witness is seldom in a position to swear that a particular weapon produced at a trial must have been used; all he can allege is that the wound was caused either by it or by one similar to it.

A man was stabbed in the face, and a knife with the blade entire was produced as circumstantial evidence against his assailant, the surgeon having stated that the wound had been caused by that particular knife. The wounded man recovered; but a year afterwards an abscess formed in his face, and the broken point of the weapon used by the assailant was discharged from it. The wound could not therefore have been caused by the knife which was produced as evidence against the accused at the trial.

Although the criminality of an act is not lessened or impugned by an occurrence of this kind, it is advisable that such mistakes should be avoided by the use of proper caution on the part of the medical witness.

When a weapon is produced there is no difficulty in answering the question: "Could this weapon have inflicted this wound?" but the difficulties immediately begin when no weapon is forthcoming, and the witness's opinion is founded on an examination of the wound only.

There are one or two fundamental properties of the skin which have a very important bearing upon this subject.

(*a*) **The skin is elastic,** and is in a living healthy state **slightly on the stretch** in all directions parallel to its surface. It therefore follows that in punctures with a *blunt* instrument the hole must be as a rule a little smaller than the diameter of the weapon, for the skin yields by stretching without tearing round the actual breach of continuity. (An experiment with a lead pencil on a piece of sheet india-rubber will well illustrate the point.) If the weapon is sharp at its point, but blunt elsewhere, the inequality between the orifice and the weapon may even be greater. Similarly in incised wounds the tension will draw the edges apart, so that the aperture has no accurate relation to the width of the cutting edge. A stab with a double-edged weapon may show a complete diamond-shaped aperture. while one with a single edge and blunt back may show a half-diamond shape, as below, but unless the blunt edge is very broad it is unlikely to leave more than an elliptical split with one extremity torn.

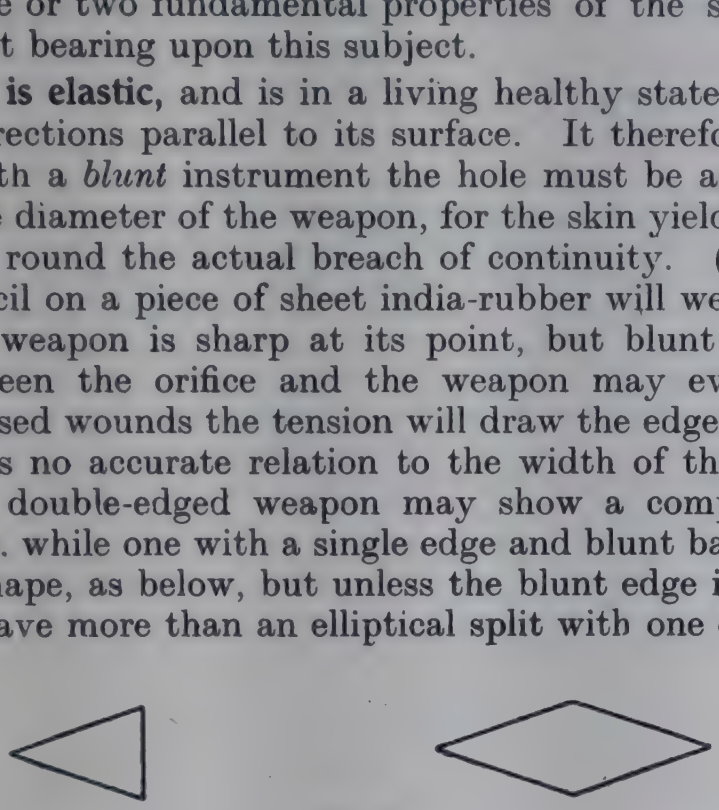

Fig. 23.

Wound of single-edged knife. Wound of double edged knife.

(*b*) The skin is **movable on the subcutaneous tissues**; **it is flexible, fairly tough, and somewhat sticky.** It follows then that when an edged weapon is drawn across the skin we may get several cuts from one action, separated from one another by small bridges of uncut skin where it got folded on itself. (Even with a sharp knife the skin may be thus dragged, for, however sharp it is, it always has some projecting points, which may catch, and with jagged and blunt knives this is true to a still greater degree.) The stickiness of the skin and the jaggedness of the weapon explain the inversion and eversion of the edges of a stab wound, showing the direction of the last force used.

We must now consider in slight detail the various forms of wounds, applying the above principles.

1. **Incised Wounds.** The sharpness of the instrument is to some extent in proportion to the cleanness and regularity of the edges; it may also be judged by the amount of blood effused, if this be known, for it is

well recognised that a vessel cut cleanly is more apt to bleed freely than one which has been torn across. Cases are known in which a limb has actually been avulsed with scarcely any bleeding, and torsion of a vessel is a well-recognised method of checking hæmorrhage from it. It must be admitted, *per contra*, that an artery half severed bleeds more freely than one completely cut across, for it can neither retract not contract.

The length of an incised wound gives no hint of the length of the cutting edge, for the point of a knife may be drawn any distance down or across limb or trunk.

2. **Punctured Wounds.** By a punctured wound is understood a wound produced by an instrument being driven in through the skin, as opposed to a cutting edge being drawn across the skin.

The depth of a stab is one of the most important points to note, for it will often give a clue to the length of the instrument used, though it must be remembered that if driven in with much violence the compression of the tissues may allow of a penetration apparently deeper than the length of the weapon.

In a murder trial the cause of death was a small punctured wound in the chest. It was five and a half inches deep; it had completely traversed the right ventricle of the heart, and had led to death from loss of blood. The wound was believed to have been produced by a small skewer, which was found near the spot; but for the defence it was alleged that the deceased had fallen over a tub, and that the wound had been caused by a projecting nail. This allegation was rejected after the surgeon had given evidence as to the depth and shape of the wound.

The careful examination of a wound once disproved a charge of maliciously wounding brought against innocent persons. A little girl was alleged to have received, while sitting over an iron grating, a wound in the pudendum by some person pushing a toasting-fork or pointed instrument between the bars of the grating from below. There were no marks of punctures, which would have been found had this statement been true, but a slight laceration of the parts, such as might have been produced by an accidental fall on the edge of the iron grating while the girl was in a sitting position. There were also marks of bruises on the thigh, such as might have occurred from an accident of this kind. A proper surgical examination of the injury established that it had resulted from accident. The part of the body in which the injury existed in this case is not usually exposed to laceration or punctures from accident; but the child for a certain purpose had placed herself voluntarily in this position, and had on her own admission slipped, and thus probably injured herself.

If it be asserted that a punctured wound was produced by a fall on some sharp body such as glass, pot, sharp stone, etc., it is almost impossible for the wound to be of any great depth without a part at least of the material being found broken off in the wound.

When a stab has traversed the body, the entrance aperture is commonly larger than the aperture of exit; and its edges, contrary to what might be supposed, are sometimes everted, owing to the rapid withdrawal of the instrument. That facts of this kind should be available as evidence, it is necessary that the body should be seen soon after the infliction of a wound, and before there has been any interference with it.

3. **Lacerated Wounds** do not in general present greater difficulty with regard to their origin than those which are incised or punctured. The means which produced the laceration are commonly indicated by the appearance of the wound. These injuries are generally the result of

accident; they are, however, frequently met with on the bodies of newborn children, in which case they may give rise to a charge of infanticide. (*Vide* "Infanticide," Vol. II.)

Glass, earthenware, sharp flints, usually produce lacerated wounds with jagged uneven edges; but, on the other hand, it must be remembered that the actual edge of a piece of broken glass is probably sharper than the sharpest of knives. It is therefore exceedingly difficult, if not impossible, to distinguish, by the mere cleanness of the edge of an individual cut between a cut thus produced and one produced by a knife. It is the **little side cuts** produced by fragments of the glass or pottery that will chiefly throw light on the nature of the wounding object, unless it happens that fragments of the glass or pot are found in the wound.

A case occurred in which a deeply penetrating wound on the genital organs of a woman, which had evidently caused her death, was attributed by the prisoners charged with the murder to her having fallen on some broken glass; but it was proved that the edges of the wound were bounded everywhere by clean incisions, which rendered this defence improbable, if not impossible. A similar defence was made on two other occasions where the cases came to trial. In one, a man struck the prosecutor, and knocked him against a window. On examination there were three deep cuts on the face of the prosecutor, but no weapon had been seen in the hands of the prisoner. He was charged with cutting and stabbing. The surgeon stated that the wounds appeared to have been inflicted with a knife or razor-blade, and not with broken glass. If the wounds had been made with glass, particles of that substance would probably have been found in them, but there were none. The prisoner was acquitted, the infliction of the wounds by a weapon not being considered to have been sufficiently made out.

In another case the prosecutor was knocked down, and his throat was found severely cut, but there was no direct proof that a weapon had been used. For the defence it was urged that the wound had been produced by a broken pane of glass, but the surgeon described it as a clean cut, five inches in length and one inch in depth, laying bare the carotid artery. He considered that it must have been inflicted by a razor or knife, and that it was a cut made by one stroke of the instrument.

In *R.* v. *Ankers*, a clean cut as from a penknife, about two inches long and one inch deep, was found on the person of the prosecutor, who had fallen during a quarrel with the prisoner. Some broken crockery was lying near the spot, and it was alleged for the defence that a fall upon this had caused the wound. This allegation was inconsistent with the clean and even appearance of the edges of the wound. The prisoner, in whose possession a penknife had been found, was convicted.

A careful examination made when a wounded person is first seen would enable a medical witness to meet suggestions of this kind.

4. **Contused Wounds**[1] present considerable difficulty to the medical jurist. It is not often in his power to say whether a contused wound has resulted from the use of a weapon, from *a blow of the fist*, or a *fall*, by reason of the deceased having accidentally fallen against some hard surface. The question is frequently put to medical witnesses in trials for homicide which arise out of the pugilistic combats of half-drunken men. One of the combatants may be killed either by a blow on the head, by a fall, or by both kinds of violence combined. The skull may or may not be fractured; and death may be the result of concussion, intracranial hæmorrhage or inflammation. The general defence is that the deceased struck his head against some hard substance when falling, and the surgeon is asked whether the particular appearances may not be explained on the

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[1] By a contused wound is here meant a contusion or bruise associated with a skin lesion.

supposition of a fall. A medical witness is rarely in a position to swear with certainty that a contused wound of the head must have been produced by a weapon, and *not* by a fall. Some circumstances, however, may occasionally enable him to form an opinion on this point. If the marks of violence are on the summit of the head, it is highly probable that they have been caused by a weapon, since this is not commonly a part which can receive injury from a fall. So if sand, gravel, grass, or other substances be found in a contused wound, this will render it highly probable that the injury was really caused by a fall. When the question is simply whether a contused wound was produced by a blow of the fist or by a weapon, it may admit of an answer from an examination of the wound, as in the following case: Two men were fighting, and one struck the other a severe blow on the head, felling him to the ground. The deceased was rendered insensible, and soon died. There was a fracture of the skull six inches in length. The prisoner alleged that he struck the deceased only with his fist. The medical opinion was that a blow of the fist could not have produced such a severe injury. Without further details it is impossible to say if this opinion was fairly justified. The fist of a powerful man has frequently caused a fracture of the skull. Much should have depended upon the position and direction of the fracture (*vide* "Fractures of Skull").

In *R.* v. *Howes*, the deceased, the wife of the prisoner, was found with severe contusions on the head and face and a lacerated wound on the temple. She died from extravasation of blood on the brain. The defence was that deceased had fallen against a fender while intoxicated, and so had caused the wounds; but it was properly stated by a medical witness that, although a lacerated wound on the side of the head might have been so caused, the other injuries bore the characters of repeated blows. Counsel for the defence wished to make a general amalgamation of all this violence, although the witness had stated that the head, from the temple to the occiput, was one mass of contusions, independently of the bruises found on the face. Apart from all scientific speculations, no fall upon a fender could possibly account for the *whole* of these injuries. The prisoner was convicted of manslaughter. A similar question arose in *R.* v. *Budd*, where a man was charged with killing his wife by blows. It appeared that he had either kicked her, and produced the injury which caused her death, or that she had fallen upon some wood as a result of this violence. It was held that it was not material whether death was caused directly by the blow or kick, or whether the prisoner struck or pushed his wife, and she fell so as to produce the injury which caused her death; the prisoner would equally be guilty of manslaughter. If it could be shown that the fall was the result of some accident, then it might be a good ground for defence. He was convicted.

The chief difficulty in regard to contused wounds arises (as has been indicated above) when the wound in the skin lies over a bone separated from it by a comparatively thin layer of soft tissue, the typical places being the scalp, cheek-bones, the back of the fingers, and a few other similarly situated skin areas. In these situations, wounds produced by blunt objects, such as a cricket-ball, hammer, stone in a stocking, etc., are commonly associated with an apparently clean incised skin wound, and only a close scrutiny of the edges and the surrounding tissue will reveal the fact of a crushed or bruised condition being present. Usually examination by a hand lens will enable the observer to see the torn extremities, the rough margins, exposed hair bulbs and torn fibres and vessels in wounds from blunt instruments. If some time has elapsed before a wound is examined, great caution will be required in forming a judgment.

A man, it was alleged, had been stabbed on the head with a knife. The prisoner struck the blow, and he certainly had a knife in his hand at the time, but whether the wound was or was not produced by the knife could not be determined from the evidence of eye-witnesses. In the defence it was urged that the prisoner had inflicted the wound with his knuckles, and not with a knife. When a surgeon was called to examine the wound some time after its infliction, there was so much contusion and laceration about its edges that it was impossible to ascertain with the necessary precision, by what means it had been caused. There was suspicion, but no medical proof, that a weapon had been employed.

A surgeon should be cautious in listening to the statements of others that a weapon has been used unless the wound itself bears about it such features as to leave the fact indisputable. During a scuffle the person assaulted may be easily deceived as to the way in which an accused party inflicted a wound upon him ; and a motive may sometimes exist for imputing to an assailant the use of a weapon during a quarrel. In such cases a medical witness should rather trust to the appearance of the wound for proof of the use of a weapon than to any account given by interested parties.

There is no doubt that some means of discrimination between the effects of falls and blows affecting the same part of the body would greatly aid the administration of justice ; but as no two cases coming under this class of injuries are precisely alike, either in the part wounded or the amount of force employed, it is scarcely possible to introduce general rules. It is commonly believed that a mere fall is not sufficient to produce the same degree of injury that may be caused by a blunt weapon applied suddenly to the head by human force ; but a severe fracture may arise from a simple accident of this kind, and present nearly all the features of homicidal violence. The difficulties at criminal trials will be found to proceed, not so much from want of rules to assign the violence to one condition or the other as from a want of proper observation when the wounds are first examined. If minute attention were given to an examination of these injuries soon after their occurrence, circumstances would be noticed which would help the medical witness to a conclusion.

The case of Mr. Briggs, who was murderously assaulted in a railway carriage, furnishes an illustration of the ease with which homicidal and accidental violence may be distinguished provided attention is directed to this question at the time. There were several wounds on the head which could not have proceeded from one cause. It appeared probable that some had been inflicted on the deceased by an instrument while he was in the carriage ; that he had been thrown from it while the carriage was in rapid motion, and the fall had produced other bruises. The surgeon who examined the deceased found a transverse jagged wound across the left ear, and above this there was a scalp tumour as well as two distinct wounds of the scalp, with effusion of blood beneath and corresponding fractures in the bones. There had obviously been more than one distinct application of force to produce such injuries. The fractures in the skull in two distinct places indicated the use of a heavy blunt weapon, while the scalp tumour was probably caused by the head coming in contact with the ground at that point.

When it is a question which of two weapons produced certain contused wounds found on the head, the difficulties of medical evidence are increased.

In *R.* v. *Teague* the accused was charged with the murder of his father-in-law. The deceased was found dead with a large wound in the centre of the forehead. According to the medical evidence, it had the appearance externally of being two, but was in reality only one wound, inflicted by more blows than one. The wound was nearly of a circular figure, with a band of skin passing vertically across it. The bone had been driven in some depth. A large hammer was found near with white hair upon it, but no blood. It was alleged for the prosecution that the contused wound had been produced by this hammer by the act of the accused, and it was stated by the medical witness that one end of the hammer corresponded to the shape and other physical features of the wound. The defence was that the injury had been caused either by a fall or by a kick from a horse. It was not at all probable that any fall could have produced such a wound without greatly disfiguring the face, which presented no marks of injury; and in reference to its production by a kick the witness compared the horse's shoes and found that the wound bore no resemblance whatever to them.

In most instances an accurate observation of the form of a contused wound, and an early comparison of it with the supposed weapon or the substance said to have produced it, will enable a witness to come to a correct conclusion on the subject. The situation, depth, and shape of the wound may be such that no accidental fall could reasonably account for its production.

In *R.* v. *Skelton* the deceased, an old man, died from violence to the head. He was found in the road insensible and bleeding, not far from the prisoner's house. An angular stone was lying near his head. There were no bruises on the body, but on the left side of the crown of the head there was a square-shaped hole about the size of a half-crown, the bone being there driven in. Three inches below this, at about the tip of the ear, there was another fracture of the skull under a narrow scalp wound about an inch in length.

In the prisoner's house was found a hammer, which had a square face, with the corners rounded off; and on comparing this with the indented wound and fracture it corresponded very nearly in shape and width. The other end, when compared with the smaller wound near the ear, also corresponded. The hammer, as it frequently happens with heavy bruising instruments, had no blood upon it, nor anything to indicate that it had been used for inflicting the injuries. The stone found near the deceased had upon it blood and mud at one corner, and a white human hair adhered to it. It was admitted by the medical witnesses that, if the deceased had fallen heavily upon this stone, it would have accounted for the smaller wound; and, in regard to the indented wound, it was suggested that, if the victim had been knocked down by a horse and trampled on, the "caulker," or square piece of iron at the heel of a horseshoe, might have produced it. At the same time it was stated that the other part of the shoe would have left some mark, of which there was no trace. The hat worn by the deceased at the time presented no identation or mark. It is probable from this description that the injury was produced by a weapon, but the evidence failed to connect the prisoner with the act.

5. **Bruises without Skin Incision.** A good deal has to be said with reference to the manner in which a bruise or effusion of blood may be caused on the following grounds :—

(*a*) It occasionally happens that the shape of a bruise corresponds somewhat closely with the shape of the bruising violence or implement.

(*b*) More frequently in bruises beneath the skin (superficial) the bruise has no relation whatever either to the shape of the object producing it or the amount of violence employed.

(*c*) There may be a deep effusion of blood without any visible external bruise whatever.

(*a*) **Bruise corresponding to Shape of Object.** In hanging, the impression caused by the cord on the neck is sometimes ecchymosed, and indicates its course with precision; so also in strangulation, when the fingers have been violently applied to the fore part of the neck, the indentations produced may serve to point out the manner in which life was destroyed. A case is mentioned by Starkie which shows that the form of an ecchymosis may occasionally furnish presumptive evidence against an accused party.

In an attempt at murder, the prosecutor, in his own defence, struck the assailant violently in the face with the key of the house-door, this being the only weapon he had near at hand. The ecchymosis which followed this contusion corresponded in the impression produced on the face to the wards of the key; and it was chiefly through this very singular and unexpected source of evidence that the assailant was afterwards identified and brought to trial.

Similarly in cases of alleged rape with struggling on the part of the victim small bruises corresponding to finger-marks may be found about the arms and legs.

(*b*) **Bruises not corresponding to the Violence.** The one important point to insist upon here is that such want of correspondence is really the commonest event, correspondence being unusual. The reasons for non-correspondence are several :—

(i.) Hæmorrhages, small or large, beneath the skin are very common as a result of disease without any violence having been inflicted. In aged persons it is not unusual to find the legs and feet covered with livid patches, sometimes of considerable uniformity of colour, and sometimes much mottled. These discolorations, which after death or during life might be mistaken for ecchymosis from violence, arise from the deficient circulation. The blood finds its way with difficulty through the venous capillaries, and the marks are commonly observed on the lower limbs because they are far removed from the centre of circulation, and the blood has to rise in opposition to gravity.

The disease known as erythema nodosum produces a condition on the shins which may be indistinguishable from bruises except by the history. The patches show discoloration like a bruise, and if they were alleged to have been caused by violence (for blackmailing or other purposes) their usual symmetry on both legs and the absence of skin abrasions over them would usually afford means of distinction.

Purpura, scurvy, hæmophilia, drug rashes, and malignant cases of infectious disease, are all illustrations of diseases in which subcutaneous spontaneous bleeding may take place. In general there is no difficulty in distinguishing such cases, during life at any rate. The multiplicity of the spots, the great diversity in their size, their symmetry, and the absence of any abrasion over the spot will serve as distinguishing features from bruises caused by violence. In myelogenous leukæmia, hæmorrhagic spots may be found in many of the mucous membranes. In whooping cough or in severe bouts of coughing from other causes bruises from the rupture of small vessels commonly occur.

(ii.) In women, in persons who are flabby, out of health, or actually suffering from one of the above diseases, it is well known that a small amount of violence will produce a large bruise, presumably because the vessels are poorly supported by the lax tissues, adipose or otherwise.

At all events, the fact is too well established to need illustrative cases. In similar persons even the act of violent vomiting or other muscular exertion may cause an effusion of blood.

(iii.) When violence is applied to the body it may happen that the vessel which gives way and so causes a bruise lies below the fascia or deep amongst the muscles. In such a case the effused blood passes in the direction of least mechanical resistance, and may, therefore, appear at a considerable distance from the seat of violence, and will take a shape entirely independent of the bruising instrument. It is a very common circumstance for a bruise thus to appear at some distance from a fracture of the leg. Usually the bruise appears at a lower level than the injury, especially in the lower limb, but the opposite may happen. For instance, Syme met with a case in which a compound fracture of the tibia was produced by a carriage wheel. There was no bruise around the wound in the skin, but after some days the skin about the knee and thigh became discoloured.

(*c*) **There may be Severe (Fatal) Effusion and no External Bruise or Abrasion.** It has been repeatedly asserted in courts of law that no severe blow could have been inflicted on the body of a person found dead because of the absence of ecchymoses or other indication of violence from the part struck ; but this assertion is opposed to well-ascertained facts. However true the statement may be that severe contusions are commonly followed by ecchymoses, it is open to numerous exceptions , and unless these are known to a practitioner, his evidence may mislead the court. The presence of ecchymoses is commonly presumptive evidence of the infliction of violence. but their absence does not negative this presumption.

Severe lacerations of internal organs with fatal effusion of blood in vehicle accidents, falls, etc., without any external bruising of the skin of the trunk are the rule rather than the exception. It is extremely rare to find bruising of the abdomen after injuries, and the absence of such bruises gives no indication of the possible state of the viscera. The following is a typical case :—

A boy *æt.* 8 was brought into the hospital dead. It was reported that he had been knocked down by a heavy cart and was supposed to have been run over. There was not the slightest trace of abrasion or bruising of the skin of the chest nor behind the ribs and sternum, but the upper lobe of the right lung had been cut completely off from the root of the lung and was floating freely in a pleura full of blood.

The explanation of the abdominal cases is not really very difficult. In the first place, the clothes prevent actual contact of a hard body such as the tyres of a motor-car with the skin. This in itself tends to spread the blow, and so to diminish its local concentrated effect. Again, the abdominal parieties if taken unawares, as they are in such cases, are soft and yielding to a broad blunt surface, while the liver, spleen, and kidneys and a *full* bladder are comparatively firm and unyielding, and so suffer laceration. It is not quite so easy to see how an intestine or empty bladder is thus ruptured, but presumably they must be pinched between the applied force and the bodies of the vertebræ.

As regards the brain, laceration by contre-coup is well recognised as a cause of hæmorrhage into the organ.

Even on the limbs it must be remembered that, to lacerate a blood-vessel, a mere compression is insufficient, unless there is a hard resisting surface to give a counter-pressure sufficient to tear the vessel or unless there is severe stretching.

6. **Abnormal Fragility of Bones.** There are quite a number of diseases which may cause undue fragility of the bones. In old age, in rickets and generally in long-standing nutritional disorders and wasting diseases some atrophy of the bones and consequent fragility may occur. Atrophy from pressure and the presence of tumours, cysts, etc., are likely to lead to weakening of bone. Fragilitas ossium and osteoporosis and their relationship to bone formation are matters which need not be discussed here as they are fully described in any text book of pathology.

It is generally accepted that fractures are more readily produced in chronic mental disease. The importance of this condition arises from the fact that when a nurse in a mental hospital is charged with gross cruelty to a patient, possibly involving a charge of manslaughter, it is assumed that great violence must have been used if several bones (ribs usually) are found to have been broken. The defence made is that no more violence was used than was absolutely necessary, and that the bones broke unusually easily. If the patient is living, a complete medical investigation with radiological examination of the bony tissues may enable the witness to give a decision on this point ; if the patient is dead, the presence or absence of any pathological condition of the bones can be established by the *post-mortem* examination.

B. Evidence from Examination of the Clothing

This is a most important part of the duty of a medical man. In a case of wounding, he should always see the clothing of the wounded person. It may throw a material light upon the *mode* in which a wound has been produced ; it may remove an erroneous suspicion of murder, and may sometimes serve to indicate that a wound has been self-inflicted for the concealment of other crimes, or falsely to impute its infliction to other persons. Marks of blood, dirt, grass, or other substances on the clothing, may also throw a light upon the mode of infliction. The position of blood-stains and direction of flow of the blood may give an indication of the position of the injured person at the time of the injury and his subsequent movements. So, again, the use of a weapon, in reference to cuts and stabs, may be inferred from the dress presenting corresponding cuts or perforations. Contused wounds may, however, be readily produced through the dress, without tearing or injuring it. Considerable laceration of the skin and muscles, and even severe fractures, may be caused without necessarily penetrating the dress, supposing it to be of a yielding nature. In self-inflicted or imputed wounds, if of the nature of cuts or stabs, there is often a want of correspondence between the perforations of the clothing and the wounds on the person ; this is one of the characters by which the correctness of a statement may be tested (see “ Imputed Wounds ”). A severe wound may be indirectly produced by a bruising weapon, and medical witnesses have been often questioned on this point. Thus the victim may at the time have worn some article which received the blow, and this may have caused the wound.

On a trial for maliciously wounding, it appeared in evidence that the prisoner assaulted a gamekeeper by inflicting on his head severe blows with a gun. At the time of the assault the prosecutor wore a strong felt hat, which, it was contended in defence, had caused the wounds that formed the subject of the charge. The medical witness admitted that the wounds might have been produced either by the gun or by the hat through a blow from the gun. The prisoner was convicted; this was held to be a wounding, although the gun did not touch the skin. In another case, a blow was struck with a bludgeon at the head of the prosecutor, who wore spectacles. Wounds were produced which, it was urged in the defence, had resulted from the glass of the spectacles, and not from the bludgeon. The prisoner was acquitted.

Every case of this kind must be determined by the circumstances which accompany it. In performing his duties, a medical practitioner is bound, as far as he consistently can, to notice, as a possible medical witness, the nature of all personal injuries, so as to be able to give an opinion on the mode in which they were inflicted.

When the question is whether the contused wound resulted from accident or homicide, a careful examination of the clothing may be of great value.

A man was found dead in a stable, not far from a vicious mare, and the harness of the animal was upon his arms and shoulders when the body was discovered. The brother of the deceased was tried on the charge of having killed him with a spade, which was found lying in the stable. This spade was stained with blood, but the evidence from this fact was rendered valueless by the circumstance that the spade had been subsequently used in cleaning out the stable. For the defence it was alleged that the deceased had been kicked by the mare while attempting to put on the traces, and had thus been accidentally killed. There were two straight *incised* wounds, apparently caused by a heavy instrument, on the left side of the head, one about five and the other about two inches long. On the right side of the head there were three irregular wounds of a mixed lacerated and incised character, two of them about four inches in length. There was also a wound on the back part of the head, about two and a half inches long. There was no swelling around any of the wounds. The right side of the skull was generally fractured, the fracture extending along the back of the head to the left side, a small portion of the temporal bone having come away. The deceased was found with his hat on, which was damaged in the part corresponding to the seat of injury, but was not cut; there were no wounds on any other part of the body. Two medical witnesses expressed a strong opinion that the injuries could not have been produced by kicks from a horse, founding that opinion principally on the distinctness of the wounds, the absence of marks of contusion, and the straight lateral direction and similarity of the wounds. They also thought that they could not have been inflicted without cutting the hat, if this had been on the deceased's head at the time; and if the hat had been off, that he could not have had the power to put it on after receiving the wounds. The case was not proved against the prisoner, and he was acquitted.

Taking the facts as they are here reported, there seems to have been no good medical reason for assuming that the wounds on the head were homicidally inflicted. The fact that they were of a somewhat incised nature was not a positive proof that the spade had been used in producing them, since an instance has occurred where the skin of the scalp represented a similar incised appearance from the kick of a horse; and this is not an unusual consequence of a severe and sudden blow on those parts of the body where the elastic skin is stretched over bone. In this case, however, another question arose, namely, whether wounds of this description could be inflicted on the head without necessarily cutting through the hat. Admitting it to be improbable that the deceased could have placed the hat on his head after being thus wounded, we must infer that it was on his head at the time, and assuming that the injury was produced by the bruising violence of a horse's hoof. it is easy to understand that the scalp might be wounded and the skin broken without causing more than an indentation in the hat. If the spade had been used, it is less probable that the hat would have escaped the effects of violence. Hence the witnesses who assumed that the deceased had been killed by the spade were obliged to conclude that the hat must have been off and put on afterwards; therefore, that there must have been interference with the body after the assault. This, however, would not explain the fact that the hat was indented over the situation of the principal injury. On the whole, this seems to have been really a case of accidental violence, this theory being strongly supported by the condition in which the hat was found on the head of deceased. It is of some important as a medico-legal fact that the skin may be readily wounded through the clothing without the latter being necessarily cut or torn. The Judge who tried the above case stated at the time that he remembered a trial at the Old Bailey where it had been proved that a cut and a fracture had been received without having cut the hat of the wounded person, and evidence was then adduced of the infliction of a similar wound without cutting the hat.

Another instructive case shows the importance of comparing the article of clothing with the injuries which may have proved mortal.

A woman, *æt.* 60, was found dead in her bed. She had vomited slightly, and on the floor there was a small quantity of blood which had flowed from her nose. She had been seen in her usual health on the previous night. On inspection, there were found two indentations about the middle of the right parietal bone, and there was a large clot of blood in this situation beneath the skin. On removing this clot, the bone was found fractured to the extent of four inches. Nearly three ounces of dark clotted blood were found on the outer membrane of the brain (dura mater), between it and the skull. All the other viscera were healthy. This was the only injury, and quite sufficient to account for death; but a question arose respecting the mode in which this fracture was caused.

It was stated in evidence that on the evening before her death the deceased had been suddenly knocked down by a man accidentally running against her while she was walking in a public road. One witness stated that the deceased fell heavily on the back of her head, on which she was wearing a bonnet. She appeared stunned, was raised up by the man, some brandy was given her, and she recovered sufficiently to walk home and to eat her supper as usual, after which no one saw her until she was found dead in bed on the following morning. Some suspicion arose that the violence done to the head was too great to be accounted for by a mere fall, and it was a question whether, with such an amount of injury, the deceased could have walked to her home, at the distance of a mile and a half, and have eaten her supper before going to bed. At first it was thought that this was a case of murder, and a man who lodged in the house with deceased was suspected. His room was searched, and a hammer with two claws was found. On comparing these claws with the two indentations and fracture the medical witness thought that this weapon would at once account for these conditions. The deceased and the lodger had been in the habit of quarrelling, and they were the only persons in the house on this occasion. The lodger said that he let the woman in about nine o'clock (the fall in the road occurred about 7.30 p.m.); her appearance presented nothing unusual, and he saw no more of her until called at seven the next morning, when she was found dead and cold. It was only at the adjourned inquest that the bonnet worn by the deceased at the time of the fall was called for by the coroner. Two indentations were then found upon the back of it, corresponding to those on the skull of the deceased. The indentations on the bonnet contained dust and dirt, thereby confirming the statements of the witness, and rendering it probable that the fall in the road had caused the fatal injury to the head.

The examination of the clothing in this case, cleared up what might have been otherwise doubtful. It is probable that the large internal effusion of blood which caused death did not take place until the deceased had reached home, and perhaps as a result of the exertion made. She must have died very soon after she went to bed, as her body was found cold at seven o'clock the next morning. This case shows that persons may walk and die at a considerable distance from the spot where serious injury to the head has been sustained.

The examination of the clothing in the Waterloo Bridge tragedy threw some light upon the question of murder. *Vide* p. 143.

With reference to clothing, it is advisable to have some clear proof that the clothes sent for examination were actually worn by the accused, or that they had belonged to the deceased and were in fact taken from the body.

In *R.* v. *Hatto*, it turned out by the confession of the prisoner, and by the discovery of other articles of clothing in places where he admitted he had concealed them, that the clothes which had been examined were not being worn by him when he perpetrated the murder. In *R.* v. *Munro*, the clothes supposed to have been worn by the prisoner were sent for examination. There was no blood on the trousers, and it appeared, from the evidence at the trial, that the prisoner had changed this article of clothing before he was arrested.

In a case of suspected murder, one should examine for blood, not only articles of clothing produced by the police, but any others that might have been worn by the accused at the time of the occurrence. In the Road murder, *R.* v. *Constance Kent*, the omission to inquire minutely in the first instance into all the articles of the clothing created several difficulties.

From the nature of the wounds on the body of the infant, it was probable that the clothing of the person who inflicted them would have been stained. She had *three* night-dresses, but only two were produced. When asked for an explanation, she said that one had been lost at the laundry a week after the murder. This was proved to be a falsehood; there was no doubt that the prisoner, soon after the murder, had secreted one of her night-dresses which was stained with blood; she then put out a clean one for the laundry to avoid suspicion, but afterwards clandestinely took this back again to her bedroom. Within twenty-four hours of the murder a chemise wrapped in brown paper and stained with blood was found by a policeman in a fire-hole in the scullery; this was most probably the missing night-dress. She stated in her confession that she burnt the dress worn on the night of the murder five or six days afterwards.

The three night-dresses should have been produced or accounted for at once; and if this had been strictly carried out, a weight of suspicion would have been removed from several innocent persons, and the perpetrator of the crime would not have remained undetected for five years.

A medical man should observe on these occasions whether the blood is deposited in large patches on clothing, or whether it is sprinkled, and also make a note of the quantity. The sprinkling may have proceeded from a wounded artery, or from a splashing of blood as a result of violence. He should likewise notice whether, if the wound is in the throat or chest, blood has flowed down in front of the clothes or person, or whether it has flowed so as to collect in the armpits, on each side of the neck, or under the back; for these appearances will sometimes show whether the wound was inflicted when the person was standing, sitting, or lying down. If the throat is cut while a person is lying down, the blood will be found chiefly on either side of the neck, and not extending down the front of the body. Few suicides cut the throat while in a recumbent posture, and the course which the blood has taken may, therefore, help to distinguish a homicidal from a suicidal wound.

The nature of the dried spots of *mud*, fragments of vegetable matter or fibres on clothing may occasionally serve to connect an accused person with an act of murder.

In *R.* v. *Snipe and other*, there were spots of mud on the boots and clothes of the prisoner, which when examined microscopically, presented infusorial shells, and some rare aquatic vegetables, particles of soap, confervæ, and hairs from the seeds of groundsel. The mud of a ditch close to which the body of the deceased was found presented the same microscopic appearances as the mud from the prisoner's boots; and the witness who gave this evidence deposed that in his opinion the mud spots were derived from this ditch. He had examined the mud of all the other ditches in the locality and found it to be different.

This circumstance connected the prisoner with the act and there was corroboration from the fact that he had been seen near the spot on the night of the murder.

In another case Taylor found granules of wheat-starch mixed with the blood-stains on the gaiters of a man charged with murder. Just before the occurrence he had been engaged in sowing seed-corn. Similarly, in *R.* v. *Steed*, on the soles of the boots belonging to the prisoner portions of farinaceous matter were discovered adhering to the nails, in addition to blood, hair and woollen fibres. After the murder the prisoner had gone into a country baker and flour-dealer's shop, and trodden on the floor, on which there was flour. These facts tended to corroborate evidence that the prisoner was the man seen in the shop.

WAS THE WOUND INFLICTED DURING LIFE OR AFTER DEATH?

The means we have for determining this important question are all connected with the reaction of *living* tissues to irritants and injuries. If a wound has been inflicted before death, some or all of the following signs will be observed :—

1. Hæmorrhage.
2. Retraction of edges of wound.
3. Signs of inflammation.
4. Signs of repair.

1. **Haemorrhage.** In another part of this work a full discussion will be found on the cessation of the circulation as a sign of death, also on *post-mortem* venous bleeding (p. 181). Again, on p. 415, the minute differences between living and dead blood (fibrin, evidence of spurting, etc.) are discussed. We are here concerned more with the *quantity* of the effused blood.

When an incised wound is the cause of death, the person dies either immediately, in which case there is copious bleeding from the wounded organ or some large vessel; or he dies after some time, in which case, as the wound continues to bleed during the time that he survives, the longer he lives the more copious will be the effusion of blood. In a wound inflicted after death, and while the body is still warm, nothing of this kind is observed. Unless the weapon injures one of the large veins, the bleeding is generally slight, so that the *quantity of blood* lost may assist us in determining whether the wound was made during life or after death. When the body has been moved, and all marks of blood effaced by washing, rules of this kind cannot serve a medical witness, and the time at which the wound was actually inflicted must then be deduced from other circumstances.

In *R.* v. *Greenacre*, where the prisoner was convicted of the murder of a woman, this formed a material part of the medical evidence. The head of the deceased had been severed from the body; and the question was whether this severance had taken place during life or after death. The prisoner alleged that it was after death; but the medical evidence was that the head must have been cut off while the woman was living, but probably after she had been rendered insensible by a blow on that part, the marks of which were plainly visible.

This medical opinion was founded on two circumstances: The muscles of the neck were retracted, and the head was completely drained of blood, showing that a copious and abundant flow must have ensued during the process of separation, and therefore indicating that the circulation was probably going on at that time. On cutting off a head after death a quantity of blood may escape from the jugular veins, but this soon ceases. The chief medical witness, Girdwood, expressed himself with proper caution by stating, in answer to a question from the judge, that the wounds in the neck had been inflicted either during life or very shortly after death, while the body still preserved its warmth. The circumstantial evidence showed that the deceased had been first stunned, and that her head had been cut off while she was in a state of stupor. If a wound is made after the blood has clotted in the vessels little bleeding can take place, but it is impossible to be didactic about the exact time at which clotting occurs in the vessels.

A *post-mortem lacerated* wound occurring as the result of accident may be attended with such an effusion of blood as to deceive a medical man, unless all the facts of the case are known. In another part of this work ("*Post-mortem* Bleeding") is described a case in which, except from the proof of accident after death, a surgeon might have come to the conclusion that the deceased had been maltreated during life. In any case in which it is doubtful whether a wound was inflicted on a living or dead body it would be most unwise to form an opinion on the extent or nature of hæmorrhage, and no opinion should be given without microscopic sections being examined to ascertain the infiltration of the blood into the tissues, the amount of œdema, the presence of leucocytes and other changes produced during life. It is a considerable step in evidence when we are able to assert that a particular wound, found on a dead body, must have been inflicted either during life or *immediately* after death; for it can scarcely be supposed that in a case calling for criminal investigation anyone but a murderer would think of inflicting upon a body immediately after death a wound which would undoubtedly have produced fatal effects had the same person received it while living.

The copious effusion of blood has been set down as a well-marked character of a severe wound received during life; but this observation applies chiefly to cuts and stabs. Lacerated and contused wounds of a severe kind are not always accompanied by much bleeding, even when a large blood vessel is implicated. It is well known that where a whole member has been torn from the body little blood has been lost; but in such cases coagula or clots of blood are commonly found adhering to the separated parts, a feature which indicates that the wound was inflicted either during life or soon after death while the blood was still warm and fluid. When a lacerated or contused wound involves a highly vascular part, such as is met with in the genitalia of either sex, it is liable to cause death by the loss of blood, although no large blood vessels may be implicated.

In *R.* v. *Crawley*, a man was charged with having caused the death of his wife by kicking her in the lower part of the abdomen. Copious bleeding followed; and, in spite of medical assistance, the woman died very shortly afterwards, evidently from exhaustion produced by the loss of blood. There was no external laceration, but an examination of the body showed that a contused wound of the genitals had been produced *internally*, and had given rise to fatal bleeding.

There is nothing at all remarkable in such a result, considering the abundance of small blood vessels in these parts of a woman. If from any cause we cannot estimate the quantity of blood lost, then the presence of small clots entangled in the tissues at the edges of the wound suggest that it was inflicted during life.

Bruises without Broken Skin: ante- v. post-mortem. It must be remembered that in a bruise without broken skin the blood has to escape under a certain amount of resistance. The force that overcomes this resistance is supplied by two factors: (1) the beating of the heart; (2) the elastic force of the arteries. At the moment of death the first of these factors disappears; the second factor sinks very rapidly, and is probably lost in half an hour. It follows from this that the *amount* of blood effused in a bruise becomes the most important point in determining whether the violence was inflicted before or after death.

If a bruise has been caused some hours before death, there will be swelling and infiltration of the part with blood, emigration of leucocytes and possibly certain changes of colour in the bruised patch, in which case there will be no difficulty in forming an opinion. Although bruising, or an appearance analogous to it, may be produced on a body after death, the changes in colour are then met with only under peculiar circumstances, to be presently mentioned. If the blood found beneath a bruised spot is clotted, this will afford a presumption of its having been effused during life, although strictly speaking, it only proves that the effusion must have taken place either before death or very soon after it, *i.e.*, while the blood was still uncoagulated but capable of coagulation. The experiments related, in speaking of incised wounds, show that blood effused from a wound after death may be found to coagulate. Again, the circumstance of the blood effused under a contused wound being *liquid* is not a proof that the effusion took place after death if the autopsy be performed very soon after death, so that the blood has not had time to coagulate, nor is it so if there has been long delay, when it may have become again fluid from decomposition. Blood effused into the spinal canal during life is often fluid, and it is well known that blood may be found coagulated in some parts of the body while it remains fluid in others. Blood coagulates more slowly in the dead body than in a vessel into which it has been drawn during life or after death. The blood may remain fluid in the vessels in a dead body from four to eight or even as long as twelve hours after death. It rarely begins to coagulate until after the lapse of four hours ; but if drawn from a blood vessel and exposed to air, it coagulates at once or in a few minutes after its removal.

In general, bruises which have been produced during life may be recognised by the *extent* of the effusion. If under the bruised parts we find a large quantity of liquid blood, and the seat of injury is so situated that the blood could not have become infiltrated into it from elsewhere, we may confidently pronounce that the effusion must have preceded death. In a dead body a bruising blow would cause but little extravasation.

The period of time after death within which a small bruise can be inflicted so as to resemble one produced during life has not been fixed with any degree of precision ; but, as in the case of incised wounds, it would seem that there is little danger of confounding them when a contusion has been inflicted on a *dead* body after the disappearance of animal heat and the commencement of cadaveric rigidity. Whenever the warmth of the body and the laxity of the muscles are not considerable at the time the blow is inflicted, the appearance of contusions during life cannot be distinctly produced. It is, therefore, only on the trunk that even in the most favourable state of the body—namely, when warmth is retained and the blood remains altogether liquid—a mark resembling a contusion on the living body can be produced so late as *two hours* after death.

Christison found that blows inflicted on a dead body not more than *two hours* after death gave rise to appearances on the skin similar to those which resulted from blows inflicted on a person shortly before death, but that at this period it was often difficult to produce a bruise. The livid discoloration thus produced generally arose from an effusion of the thinnest possible layer of the fluid part of the blood on the outer surface of the true skin, but sometimes also from an effusion of blood into a perceptible stratum of the true skin itself. He likewise found that dark fluid blood might even be effused into the subcutaneous cellular tissue so as to blacken or redden it, but this effusion was never extensive. From this, then, it follows that by trusting to external appearanee only contusions made soon after death may be confounded with those which have been produced by violence shortly before death.

The *earliest period* after death in which an experiment was tried on the human body was *one hour and three quarters* ; in this case the similarity was so strong that if the experiments had been performed within half an hour, or even an hour, after death, it would have been difficult to state positively whether the blow producing the discoloration had been inflicted on a living or on a dead body. Christison's experiments lead to the conclusion that *severe* blows inflicted on a body recently dead produce no greater degree of ecchymosis, or cutaneous discoloration, than *slight* blows inflicted on the living. Assuming that the great extent of an ecchymosis would in all cases serve to show that the violence which produced it had been inflicted during life, it must be remembered that the importance of these facts in relation to medical evidence is not affected by the extent of the discoloration. It may be just as necessary to have a positive opinion on the origin of a *slight* as on the origin of an *extensive* bruise. Slight ecchymoses, as in cases of strangulation or suffocation, if they can be certainly pronounced as *ante-mortem*, may make all the difference between the acquittal and conviction of a person charged with murder. Again, slight ecchymoses on the bodies of the drowned may excite a suspicion of strangulation and subsequent immersion of the body in water. So in reference to child-murder, an infant may be killed by violence, and only a few slight marks of ecchymosis be found upon its body.

As a rule, however, a bruise inflicted before death shows infiltration of the tissues with blood, that is to say the blood is actually forced in amongst the tissues. No amount of violence inflicted after death can produce this appearance, which depends on the pressure of the beating heart.

It may be said that the finding of a few extravasated red cells in the tissues is not necessarily proof of *ante-mortem* injury, for if considerable violence were used after death it is quite possible that a certain number of cells might be driven from the ruptured capillaries into the tissues, enough possibly to confuse the issue in the examination of a microscopic section. In general, however, the difference is quantitative rather than qualitative, and the amount of the extravasation and its distribution should be sufficient to warrant a definite opinion from an experienced observer.

Violence inflicted **on a living body may not show itself in the form of a bruise until after death.** A man received several kicks on the lower part of the abdomen which caused a rupture of the bladder and death from peritonitis. He died in about thirty-five hours ; but there was no visible bruising in the seat of the blows—*i.e.*, in the pubic and lumbar regions—until after death. Hinze met with a case of suicidal hanging in which it was observed that ecchymosis appeared in the course of the cord only after death. No doubt it was produced before death, but the compression of the cord prevented it showing itself externally.

A medical witness must therefore be on his guard against the error of supposing that when a blow has been inflicted on a living person it is necessary that the person who is maltreated should survive for a long period in order that a bruise should be produced. These facts simply prove that the cause producing the effusion of blood may operate during life, but that there may be no appearance of it until after death. The following case shows how facts connected with bruises may require interpretation.

A man was seen to strike one of his companions. The person struck died suddenly. On a *post-mortem* examination the mark of a bruise was seen over the sixth and seventh ribs on the right side. About a fortnight before this blow was struck the deceased had met with an accident : a heavy box fell on his right side, knocked him senseless, and nearly killed him. The question at issue was, whether the bruised mark on the side was attributable to the blow struck shortly before death or to the fall of the box upon his body a fortnight previously.

Such a case does not present much difficulty. If the ecchymosed mark is blue or livid and without any marginal colours, it was probably the result of the blow struck just before death. If the blood is fluid at the time of violence, and the small capillary vessels are torn through, a blow may cause effusion and the production of a bruise on the skin. The warm liquid blood thus effused will find its way into the cellular tissue, and produce the usual external appearance. If, in the case quoted, the bruise had been produced a fortnight before, it would have shown some changes of colour at the margin (*vide* "Colour of Bruises"). Microscopic examination should leave the observer in no doubt in such cases.

For details on the differences between bruising and *post-mortem* hypostases *vide* "Hypostases."

2. **Retraction of Edges of the Wound.** As we have already noted, the healthy skin is during life slightly on the stretch; the muscles are, too, in a similar condition of "tone." Consequently, if in a wound on a dead person we find the skin gaping and the muscles retracted, in a manner which cannot be accounted for by the effects of *rigor mortis*, we are justified in asserting that the wound was inflicted either during life or very soon after death, while the muscles were still contractile, and while there was still local life in the skin provided that the wound is not in such a position and of such extent that the mere weight of the parts might have dragged it open.

On this point as well as incidentally on the other points the following experiments are valuable:—

In conjunction with Aston Key, Taylor performed some experiments on recently amputated limbs. *Two minutes* after a leg had been amputated a deeply incised wound was made in the calf. It must be borne in mind that in the case of an amputated limb blood will have drained from the severed member, and that the conditions are not precisely those of a wound inflicted after death upon the unsevered limb. At the moment that the wound was made the skin retracted considerably, causing a protrusion of the adipose substance beneath; the quantity of blood which escaped was small; and the cellular membrane, by its sudden protrusion forwards, seemed mechanically to prevent its exit. The wound was examined after the lapse of twenty-four hours; the edges were red, bloody, and everted; the skin was not in the least degree swollen, but merely somewhat flaccid. On separating the edges a small quantity of fluid blood escaped, but no coagula were seen adhering to the muscles. At the bottom of the wound, however, there was a small quantity of coagulated blood; but the coagula were so loose as readily to break down under the finger. In a second experiment *ten minutes* after the separation of the member from the body, a wound of similar extent was made on the outer side of the leg, penetrating to the deep-seated layer of muscles. In this case the skin appeared to have already lost its elasticity, for the edges of the wound became slightly everted, and scarcely any blood escaped from it. On examining the leg twenty-four hours afterwards the edges of the incision were pale and perfectly collapsed, presenting none of the characters of a wound inflicted during life. At the bottom of the wound, and enclosed by the divided muscular fibres, there were some coagula of blood; but these were fewer than in the former experiment. A portion of liquid blood had evidently escaped, owing to the leg having been moved. Other experiments were performed at a still later period after the removal of the limbs, and it was found that in proportion to the length of time suffered to elapse before the production of a wound so were the appearances less distinctly marked; that is to say, the less likely were they to be confounded with similar injuries inflicted upon a *living* body. When the incised wound was not made until *two or three hours* after the removal of the limb, although a small quantity of liquid blood was effused, no coagula were found.

3. **Signs of Inflammation.** Inflammation is a process which can only be carried on by living tissues, hence if we find about a wound any swelling, effusion of lymph or pus, adhesion of the edges, it not only indicates that the wound was inflicted during life, but it may also give some indication as to the time when it was inflicted (*vide* "Scars" and "When was this Wound Inflicted?").

4. **Signs of Repair.** Scabs, granulation tissue and the growth of epidermis over a wound, prove conclusively that it was inflicted some considerable time before death.

IF BEFORE DEATH, HOW LONG DID THE VICTIM SURVIVE ?

With regard to the living, this question has already been discussed. When a person is found dead the question still maintains its importance, but from rather a different point of view, for it is now not so much a question of duration of survival, but rather of what the victim could have done after receiving the wound (*vide* " When was this Wound Inflicted ?").

Acts of Volition after Reception of an Injury

It is obvious that this question can hardly arise in connection with a large number of injuries. Even in cases of fractured legs the victims have been known to drag themselves considerable distances. We shall discuss only the following :

Injuries to head and brain.
Injuries to the throat ; speech after throat is cut.
Injuries to the heart.
Rupture of abdominal viscera..
Violent struggling after injury.

Injuries to the Head and Brain. Cases frequently occur in which a patient who has received a blow on the head survives several hours or days, although the injury to the cranium is such as would, in the absence of any history, have given rise to the opinion that he must have died instantly. On the other hand, a person may fall lifeless from a blow which produces no appreciable physical changes in the cranium or its contents, whereas, if the facts had been unknown, it might have been inferred that the person had survived some hours or days. Thus we see that it is by no means easy to determine from an examination of a wound in a dead body how long the person lived after its infliction. But it must not be understood that an opinion on this subject is never to be expressed from the nature and extent of an injury, but what should be impressed upon a medical witness is, that it must not be hastily given. A wound may be mortal, but it by no means follows that it must have destroyed life instantaneously.

The medical opinion, in an abstract question of this kind, is commonly based on individual experience, but the real question is not whether the witness himself has seen such a case, but whether such a condition of things is possible. A witness is allowed to express an opinion from general professional knowledge and experience.

The fact that a person after receiving a blow on the head sometimes recovers consciousness and performs acts of volition, but subsequently becomes unconscious again, is now used as an ordinary point of differential diagnosis between meningeal hæmorrhage—*i.e.*, bleeding into the coverings of the brain—and cerebral hæmorrhage—*i.e.*, bleeding into the brain itself.

Speaking in general terms, it must be admitted that even extensive damage to the brain is no proof that the victim died instantaneously, nor that he could not have performed acts of volition after the injury. The locality of the brain which is injured will in a few cases enable us to express a decided opinion, though one of the cases detailed below shows that even this rule is not without exceptions.

In *R.* v. *Milner and others,* in which a man had been assaulted by the prisoners and had died from the injuries sustained, the temporal bone had been beaten in, and the base of the skull fractured; there was a large coagulum of blood effused on the left side of the brain, which by its pressure had flattened this organ. Notwithstanding these injuries, the deceased walked a considerable distance, and he survived about twelve hours.

Two men quarrelled in a public-house, and one struck the other in the face with an umbrella. The victim not only walked from the cab into the London Hospital, but showed so little sign of brain injury that he was allowed to go home, and symptoms did not set in for forty-eight hours, during which he walked and talked as usual. At the autopsy, the end of the umbrella, four and a half inches in length, was found embedded in the bones of the base of the skull, and had penetrated completely through the Pons Varolii (a region of the junction of brain and cord, usually considered a very fatal region).

In one of our cases a man committed suicide by shooting himself with a .45 revolver. The bullet entered under the chin, passed through the floor of the mouth and tongue, entered the skull just behind the roof of the left orbit, passed through the left frontal and temporal lobes of the brain and made its exit through a hole 1¼ inches in diameter at the top of the head. Bits of bone and brain matter were driven to the roof of the shelter in which the suicide occurred. The injury was inflicted prior to 6.30 a.m., and after shooting himself the man walked round the gardens in the snow for at least 165 yards, returned to the shelter for an indefinite period, then walked across the road to the house where he lived at 7.30 a.m., spoke reasonably and intelligibly to the maid who let him in, hung up his overcoat and umbrella, walked upstairs and collapsed. Death occurred about 10.30 a.m.

Cut Throat. A man is found dead in his bedroom with his throat cut, and the incision is proved to involve one or both carotid arteries. The medical inference may be that death was immediate. If this be true, the weapon ought, of course, to be found either in the hand of the deceased or close to his body, but it is lying in another room, and there are marks of blood between the two rooms. What, then, is the conclusion? Either that the medical opinion is erroneous, and the deceased could not have dropped down dead *instantly*, or that he must have been murdered. Unless circumstances tend to expose the error of the medical statement, irreparable injury may be done to an innocent person. The medical opinion has always given way when circumstances refuting it appeared, but it is the duty of a medical witness to profit by such errors, and to apply his opinions with greater caution to similar cases.

Wounds of the carotid arteries are often pronounced *instantaneously* mortal, but opinions of this kind have not only been refuted by circumstances, but also by the evidence of eye-witnesses. A medical witness must admit that a person may survive for a longer or shorter period after such an injury.

There are several cases on record which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent a person from **exercising voluntary power,** and even running a certain distance.

A man was found with his throat cut. The external carotid artery and the jugular vein on the right side were cut through, and a large quantity of blood was lost. The wound extended from the front of the angle of the right jaw to near the windpipe, which was not wounded. The man survived half an hour, but he was speechless and insensible. The bleeding had been partly stopped by a cloth thrust into the wound. It was left doubtful from the evidence whether this wound was inflicted by himself or by another.

In *R.* v. *Danks,* the deceased woman died from a wound in the throat inflicted by the prisoner. The wound divided the trunk of the carotid artery, the principal branches of the external carotid, and the jugular veins. It was probable, if not certain, that, after the infliction of this wound, the woman ran twenty-three yards and climbed over a gate, the time required for the performance of such acts being at least from fifteen to twenty seconds. Most medical witnesses would probably have been of opinion that the woman could not have moved from the spot where such a wound had been inflicted; but it was clear that she had gone this distance. There was no dragging of the body, and no motive for its being dragged by the prisoner, and exposed in an open road, where it was found.

A girl was brought into the London Hospital with the left internal jugular vein cut through and the left common carotid severed all but a small fragment of tissue. Her throat had been cut by a jealous lover, who had also gashed the back of her neck. Notwithstanding these severe wounds, she had run about sixteen yards into a public-house before falling down. She died in about two minutes.

A city clerk, upon arriving home one evening in January, found his house in darkness and his wife, its sole occupant, lying dead upstairs. A medical witness found in the back kitchen on the ground floor a quantity of blood clot, and a small looking-glass and a razor, both blood-stained. Upstairs, in the front bedroom, the body was found lying sideways on a chair, the head resting on the bed. A wound, two inches long, extended across the throat from left to right, partially severing the windpipe and dividing a number of blood vessels on each side. Her clothes about the neck and chest were saturated with blood. There were blood-stains on the bed and some on the stairs and passages. She had walked without assistance from the sink downstairs up to the bedroom. Since *rigor mortis* had not set in, and as the blood on her neck was quite dry, it appeared that she must have been dead for three or four hours. The wound was such as might have been self-inflicted, and at the inquest a verdict of suicide was recorded. A cause for her act subsequently came to light.

Speech is assuredly an act of volition, and the question of **whether or not a person with his throat cut can speak** is one of great importance, for if he be unable to use his voice so as to call for assistance murder may, in this way, be quietly committed without persons in an adjoining room hearing any noise, and the fact is that when the windpipe is divided, as it generally is on these occasions, the voice is usually lost. Harvey Littlejohn,[1] however, quotes a most unusual and instructive case in this connection. A woman cut her throat, the windpipe being completely divided two inches *below* the vocal cords. On the arrival of a physician she was sensible, and said that she had torn a tumour out of her neck because it was choking her and that she wanted to die.

She died shortly afterwards. Littlejohn found that the trachea was cleanly cut through and that the upper end of the divided tube projected from the wound together with six and three-quarter inches of the œsophagus. Beside her was a small tumour, consisting of the right lobe of the thyroid gland, which she had torn out with the gullet. In this case the woman was able to speak after cutting the trachea *below* the vocal cords.

In another case[2] a boy's throat was cut across and the larynx divided just *above* the vocal cords. The wound severed the facial and lingual arteries and also divided the anterior wall of the œsophagus. Shortly after the infliction of the injury he was alleged to have spoken and made a statement involving certain persons. The nearest medical officer did not arrive till after the boy was dead. He saw the injuries and held the *post-mortem* examination. He gave his opinion that the gaping wound of the throat rendered speech impossible from the moment of its infliction. Medical opinion to the contrary was, however, obtained by the defence. It was stated by this authority that, the wound being situated *above* the vocal cords would not have prevented the boy from speaking fairly loudly and fairly distinctly, though the voice would naturally grow fainter as the boy gradually succumbed owing to loss of blood.

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[1] "Forensic Medicine" (J. and A. Churchill), 1925, p. 196.

[2] *Lancet*, 1909, 1, p. 1501.

In such a case the voice of the victim would be much impaired, but even though the injury to the larynx were very complete and the wound gaped greatly, yet a portion of the expired air might pass into the mouth and give rise to sufficient voice to be heard and understood.

Wounds of the Heart. Every penetrating wound of the heart was formerly considered to be instantaneously mortal, and the usual medical opinion at coroners' inquests was that a person so wounded must have dropped down dead on the spot. More accurate observations have, however, shown that this is an erroneous doctrine.

The Duc de Berri, who was murdered in Paris in 1820, survived eight hours after having received a wound in the left ventricle of the heart.

When the cavities of the heart are extensively laid open, death is likely to be an immediate result ; but persons who have sustained wounds of this organ have frequently lived sufficiently long to exercise the power of volition and locomotion.

Watson met with a case in which a man who had been stabbed in the right ventricle ran *eighteen yards* after having received the wound. He then fell, but was not again able to rise ; he died in six hours. On dissection it was found that a punctured wound had extended into the right ventricle in an obliquely tranverse direction, dividing in its course the coronary artery. The pericardium was nearly filled with blood, and about four pounds were effused on the left side of the chest. A case of the preservation of volition and locomotion after a severe wound in the heart will be found reported in the *Med. Gaz.*[1] The patient, a boy, survived five weeks, and employed himself during that period in various occupations. After death a mass of wood was found lodged in the substance of the heart. Had this boy been found dead with such an injury, it is most probable the opinion would have been that his death was instantaneous. Darling, of New York, had a case which occurred in 1855, in which a man survived for a period of *eleven days* a bullet wound of the heart. On inspection there was no effusion of blood ; the pericardium was much distended with serum, the result of inflammation. A bullet, one-third of an inch in diameter, was found lodged in the fleshy partition between the right and left ventricles, about midway between the apex of the heart and base of the ventricles. There was no communication with the cavities ; the wound had entirely cicatrised and inflammation of the pericardium was obviously the cause of death. Some years ago a man was admitted into Guy's Hospital who survived twenty-four hours after the infliction of a penetrating wound of the left ventricle.

In 1854, an Italian, *æt.* 38, discharged a brace of pistols into his chest on the left side. The man was brought into Guy's Hospital, and was able to converse on his condition, and lived one hour and fifteen minutes after the infliction of the wound. After death it was found that one bullet had perforated the pericardium, entered the right ventricle, and, after traversing the septum of the ventricles, made its exit from the heart at the junction of the left auricle with the ventricle. It traversed the upper lobe of the left lung, and was found fixed in one of the vertebræ. The second bullet perforated the left ventricle, and then traversed the left lung. This wound was of such a nature that, at every contraction of the ventricle, the opening must have been closed so as to arrest the flow of blood. This man, owing to severe suffering, rolled about the floor, and was with difficulty kept quiet. It will be seen that in this case there were bullet wounds traversing completely the cavities of the heart ; yet the man could talk and exert himself, and he actually survived their infliction *one hour and a quarter*.

Had the body been found dead in a suspicious locality, the discovery of such wounds in the ventricles of the heart might probably have led to a hasty medical opinion that the death of the man must have been instantaneous. In these cases little or no blood probably escapes from the heart in the first instance, but it may afterwards continue to ooze gently, or suddenly burst out in fatal quantity. It must not, therefore, be supposed when a person is found dead with a wound of the heart, attended with abundant hæmorrhage, either that the flow of blood took place in an instant or that the person died immediately and was utterly incapable of exercising any voluntary power. Only one condition will justify a supposition of this kind; namely, when the cavities of the organ are largely laid open. This remark applies especially to wounds of the auricles which have but little contractile power.

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[1] Vol. 14, p. 334.

Of late years many cases have been reported in which recovery has taken place after wounds of the heart. Ballance[1] tabulates 152 cases of operations on the heart, many of which were successful. If the hæmorrhage occasioned by the injury is not sufficient to cause death by the embarrassment of the heart, the organ is able to undergo a considerable amount of repair, and though there is always a danger of the formation of an aneurism, in many cases a good firm scar has been obtained.

Ruptures of the Diaphragm. A rupture of the *diaphragm* has been considered sufficient to deprive a person of the power of locomotion; but there appears to be no good ground for this opinion. The general effect of such an injury is to incapacitate a person; but still in some cases a power of moving and walking may be retained after a rupture of this muscle. In the following instance, reported by Devergie, the proof of locomotion was material:—

An intoxicated man, after having been maltreated by another, returned home, walking for at least two hours with two companions. The man died in fifteen hours; and on inspection, among other severe injuries, there was found a recent longitudinal rupture of the diaphragm about two inches and a half in extent, and the stomach protruded through the aperture.

The question was, When could this rupture have taken place? for it was undoubtedly the cause of death. Was it possible for a person, with a recent rupture of the diaphragm, to walk for two hours? The medical witness admitted the possibility of the deceased being able to walk in the circumstances, but he thought it very improbable. There was no evidence to show that the deceased had been attacked or beaten by his two companions in journeying homewards; and, therefore, there could be no reason for inferring their guilt simply because locomotion after such an injury was something unusual as a matter of medical experience.

A man fell from a height of twenty feet. He had fractured both arms, and had sustained other severe injuries. On the day after admission into the hospital he complained of a fixed pain on the left side. He survived about thirteen weeks. On inspection the diaphragm was found lacerated in two places, in one to the extent of an inch and in the other to the extent of six inches.[2]

In a case admitted into Guy's Hospital, the patient survived the only accident which could have produced the rupture for at least *nine months*.

The man had fallen on the deck of a vessel from a great height six months prior to his admission. His ribs were fractured, and one ankle was so injured as ultimately to render amputation necessary. The man sank under the operation three months after admission; and on inspection it was found that the stomach and the colon occupied the left side of the chest, having protruded through an aperture in the muscular part of the diaphragm, two and a half inches in extent. This hernia was evidently of old standing, as the aperture was cicatrised, and the omentum adhered to it. The existence of this injury was quite unexpected, and at the time of admission there was nothing to interfere with locomotion and exertion except the injury to the ankle.

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[1] Bradshaw Lecture, December 11th, 1919.

[2] *Med. Gaz.*, vol. 39, p. 205.

This injury is far from being immediately fatal and a great many cases have been recorded of complete recovery after rupture. *Vide* also cases in " Is this Wound Dangerous to Life ? "

Ruptures of the Liver, Spleen, or Kidneys, unless attended with great loss of blood, do not prevent a person from exercising muscular power.

Ruptures of the Bladder. In ruptures of the *bladder* attended with extravasation of urine, a question may arise respecting the retention of the power of locomotion. The following cases will show that this power exists.

A man, *æt.* 31, while intoxicated, received a blow on the lower part of his abdomen. He was sobered by the accident, and walked home, a distance of a quarter of a mile, although suffering severe pain. He died four days after the accident. On inspection there was no mark or ecchymosis on any part of the abdomen. The bladder was ruptured in its upper and back portions for about an inch.

A gentleman who had been compelled to retain his urine fell accidentally in descending a staircase, with the lower part of his abdomen against the edge of one of the steps. The sense of fulness in his bladder immediately ceased, and he walked to a friend's house to dinner. The nature of the accident was mentioned to a surgeon there present, who immediately suspected that the bladder must have been ruptured. The case terminated fatally in twenty-four hours.

A case is reported in which a man walked a distance of two miles after having sustained a rupture of the bladder ; and in another the man, who sustained the injury in a scuffle, was able to walk between two and three hours after the occurrence.

From these various instances, it is evident that locomotion and muscular exertion may take place after an accident of this description.

The medico-legal relations of this subject will be apparent from the following case :—

A man passed some hours convivially with a few friends, after which a quarrel ensued, blows were exchanged, and the parties wrestled with each other. The deceased then walked home, a distance of more than a mile ; and in crossing the threshold of his own door he fell forwards on his abdomen. When lifted up he complained of great pain, and was put to bed, being quite unable to exert himself. He died in two days, and upon dissection the bladder was found ruptured at its upper part (fundus) to the extent of between two and three inches. In these circumstances, it became a question whether the rupture was caused by the violence of his companions, or by the accidental fall at the door of his own house. If by his companions, he must have walked more than a mile with his bladder ruptured : but two medical witnesses declared that he could not have walked this distance after the rupture, and consequently that it must have been occasioned by the subsequent fall.

The symptoms of rupture and extravasation of urine occurring immediately after the fall rendered it highly probable that this accident was really the cause. At the same time it is obvious that the power of locomotion may be exerted in such circumstances to a much greater extent than is commonly supposed.

The question is sometimes restricted to the mere possibility of *survivorship for a given period* without active exertion. If the power of locomotion is retained after severe injuries to important organs, there can be no difficulty in supposing that life may continue for a longer or shorter time when the person remains in a quiescent state. A medical witness must always be prepared to make full allowance for acts indicative of life in persons severely wounded.

Struggling after Severe Wounds. The power of moving, if not exerted to a large extent, may take place in a small degree; and this may become occasionally a material question in legal medicine. Thus it must not be lost sight of when we are drawing inferences as to the relative positions of an assailant and a murdered person from the situation in which a body is found. A dead man with a mortal injury to the head or heart may be found lying on his face when he actually fell upon his back, but still he might have retained sufficient power to turn over before death; or he may have fallen on his face, and have afterwards moved, so that his body may be found lying on the back. A slight motion of this kind is very easily made; it does not always depend on volition. Individuals suffering from severe concussion have been frequently known to perform acts unconsciously and automatically. The medical witness must bear in mind that he is not required to state in how many, out of a given number of persons similarly wounded, this power of performing acts indicative of volition and locomotion may remain, but simply whether the performance of these acts is or is not *possible*. It is on this point only that the law requires information. The hypothesis of guilt, when we are compelled to judge from circumstances in an unknown case, can only be received on the exclusion of every other reasonable explanation of the facts. On surgical opinions or treatment such cases, from their rare occurrence, may have little influence; but in legal medicine the question is widely different. Medical facts, however rare, here admit of a very important and unexpected application.

Although, in cases of severe wounds, we may allow that persons may survive for a sufficiently long period to perform various acts of volition and locomotion, yet the presence of a mortal wound, especially when of a nature to be accompanied by a great loss of blood, must prevent struggling or violent exertion on the part of the wounded person; such exertion we may consider to be incompatible with his condition. A medical jurist may thus have it in his power to determine whether a mortal wound found on the deceased has been inflicted for the purpose of murder, or in self-defence.

A man was tried for the murder of a woman at Liverpool by stabbing her in the chest. The prisoner and the deceased, with two other women, were quarrelling in the passage of a house. A struggle ensued between the prisoner and the deceased, which one of the witnesses said lasted for *ten minutes*. When the prisoner had reached the door, he pulled out a knife and stabbed the deceased in the chest. She fell, and died almost immediately. The prisoner alleged that he was attacked by several persons, and that he stabbed the woman in self-defence. The judge said that if the blow had been struck with premeditation before the struggle, the crime would be murder; if during the struggle, it would be manslaughter. The medical evidence showed that the blow could not have been struck before the struggle, because it was of a speedily mortal nature; and the deceased would not then have been able, as it was deposed to by the witnesses, to struggle and exert her strength with the prisoner for *ten minutes* afterwards. This being the case, it followed that in all probability the deceased had received the wound towards the conclusion of the quarrel; and therefore it might have been inflicted while the prisoner was attempting to defend himself. The jury returned a verdict of manslaughter.

This question was involved in *R.* v. *Hobbs*.

The prisoner was indicted for the wilful murder of a man with whom he had been drinking and quarrelling. It appears that in the early part of the quarrel the deceased threw the prisoner down and struck him. The deceased was told by the landlord of the inn to go home. He replied, " Very well," and then, leaving the prisoner, went through the entrance-arch of the inn up the yard. In about *seven minutes* the deceased, who had complained to the landlord of the maltreatment which he had undergone, returned into the inn-yard, and was seen on entering it to pull down his waistcoat and button his coat. A witness advised him to go home, and he left the spot. A short time afterwards he was found at the back of the yard, lying dead on his face. On examining the body it was ascertained that the deceased had been stabbed in two places, one of the stabs having penetrated a ventricle of the heart. On arresting the prisoner a large clasp-knife was found in his pocket, stained with blood. The prisoner admitted that he had stabbed the deceased, but said it was *during the quarrel*, and that he had used the knife in self-defence while they were on the ground. For the prosecution it was alleged that the deceased had been stabbed by the prisoner subsequently to the quarrel—that he had gone through the gate into the yard to meet the deceased, had there stabbed him, and had caused his instant death. A medical witness who was called stated at first that from such a wound death must have been *instantaneous*. In cross-examination, however, he admitted that the deceased might have lived some time after he had been stabbed; and on this evidence the prisoner was convicted of manslaughter.

The medical facts of the case are imperfectly reported; hence it is difficult to give a definite opinion respecting the time at which the deceased was stabbed in the heart. The size of the stab in the ventricle is not stated, nor was it in evidence whether any blood was found on the spot where the deceased was struggling with the prisoner. That the deceased should have struggled with the prisoner for one minute after he had been stabbed in a ventricle of the heart is contrary to probability. It is also irreconcilable with the existence of such a wound that the deceased should have been stabbed in the heart without knowing it, or without being aware of his condition; that he should have been able thereafter to walk away through the inn-yard to the house, and survive seven minutes while thus walking. Taking the facts as reported, it would appear probable that the deceased was stabbed by the prisoner subsequently to the quarrel, while he was walking in the inn-yard. The only circumstances in favour of the defence were the prisoner's statement and the fact that, in some cases, wounds of the heart do not prove immediately fatal.

In R. v. *E. M. Brown*, the prisoner was charged with the murder of her husband by blows on the head while in her room. Her statement was that the violence on the head was produced by the kick of a horse. The medical evidence showed that the bones of the nose were broken; there was a triangular wound exposing the bone above the left eyebrow, another triangular wound exposing the bone at the top of the head, and a third wound at the back of the head. The left ear was perforated; and behind it was a long wound divided into two. The frontal bone was fractured from the orbit through the parietal into the occipital bone. Seven pieces of bone, varying in size from half an inch to three inches, had been driven into the brain, and a large quantity of blood was effused. The prisoner's account was that she found her husband thus wounded and bleeding outside the house, that she dragged the body into an inner room, and, further, that, though thus wounded, he held her tightly by the clothes for two hours afterwards. It was proved that there was no blood over the front of the person or dress of the deceased, and that there was no blood in the passage or in any part of the house, except in the room where the body was found lying. Further, the injuries were not such as a kick from a horse would account for; and the medical witness said that a man thus injured could not have held the prisoner by the clothes for two hours, so as to prevent her from seeking earlier for assistance. These facts showed that the deceased had been killed by blows where the body was actually found. The prisoner was convicted.

WAS THE WOUND THE RESULT OF ACCIDENT, SUICIDE OR HOMICIDE?

If a wound which is found on a dead body is proved to have been caused before death, it may be necessary to inquire whether it was the result of *accident*, *suicide* or *homicide*. It may at first sight be considered that the determination of a question of this nature is wholly out of the province of a medical witness. In some instances it may be so, and the decision is then left to the legal authorities ; but in a large number of cases it is so closely dependent for its elucidation on medical facts and opinions that a jury could not arrive at a satisfactory decision without medical evidence. Let us suppose, then, that a medical witness is consulted in a doubtful case. What are the matters to which he should direct his attention ?

1. There must be no disturbance of the body.

Evidence from wounds.

2. Suicidal *v.* accidental wounds.
3. Accidental stabs.
4. Evidence from the situation of the wound.
5. Evidence from the nature and extent of the wound.
6. Evidence from the direction of a wound : stabs.
7. Evidence from multiplicity of wounds : two or more mortal wounds ; which was first inflicted ? foreign bodies in wound.

8. Evidence from the surroundings : position of body and clothes ; blood marks on body and in room ; footprints, fingerprints, etc. ; disorder or damage to the furniture ; the quantity and position of blood.

9. Evidence from the weapon : position ; nature of edge ; bloodstains ; hairs and other foreign particles on a weapon.

10. Evidence from an examination of the assailant.

The following brief epitome of evidence is inserted as a useful reference :—

Evidence may be derived from—

(*a*) Position of body and clothes.	(*a*) The body contorted and disturbed and the clothes disarranged (evidence of a struggle) is *primâ facie* evidence of homicide. Note the amount and especially the position of the blood, and consider how it arrived at its situation.
(*b*) Wounds :—	
Number.	(*b*) Many slight wounds often indicate suicide ; if two or more important organs are wounded it is suggestive of an impatient suicide. Many wounds on hands may be from attempts at protection, or from drawing out a weapon in suicide (known). *Per contra*, many deep wounds may suggest brutal violence.

Position.	There is hardly a position, even in the back, in which a lunatic may not contrive to wound himself suicidally, but a wound running *upwards* is not likely to be suicidal. Hammering on the head, driving in of nails, chisels, etc., are lunatics' tricks; wounds of genitals are usually suicidal in men, at any rate; in women, this is not so true.
Nature.	Bruises are rarely suicidal except in lunatics; but dynamite in the mouth and red-hot irons driven into abdomen are occasionally resorted to by suicides.
Direction and depth.	A cut is usually shallower at its termination; hence it is sometimes possible to tell whether a wound was made from left to right or *vice versâ*; but an assailant's hand from behind coming in front, acts like one's own hand starting in front. Homicidal cut throats are usually more horizontal and more undercut; suicidal cut throat wounds usually run downwards; suicidal stabs are usually on the left side, *i.e.*, made with right hand, and run downwards. A determined suicide may actually notch the vertebræ in cutting his throat, but the sharpness and weight of weapon and the strength of the victim must be considered.
Bruises, finger-marks, etc.	These want explanation either from violence of attack or defence.
Direction of flow of blood.	Will possibly give a strong clue to the position of the victim, which may be important.
(*c*) Surroundings :—	
Furniture.	(*c*) In disorder, finger-marks on it (*vide* "Identity"), broken, etc., as evidence of struggle.
Floor.	Bloody footsteps, etc.
Weapon.	Note the presence of blood or hair on it; whether it is gripped firmly in the hand; if absent, why absent? thrown away or hidden, etc.; if present, its position, etc.
(*d*) The accused.	(*d*) The presence of blood stains, injuries, etc., should be noted as well as his general condition, physical power, etc.

1. **The body must not be disturbed.** It is important that there should be no disturbance of the body, of the weapon, of articles of furniture, or of other matters in the immediate vicinity. If the position of the body or the weapon has been carelessly interfered with, or the arrangement of the clothes altered, this may materially affect a medical opinion. If the position of the deceased with respect to surrounding objects has been disturbed, if the weapon has been removed, and the body transported to a distance, then it may not be easy to distinguish a wound accidentally received from one inflicted by a suicide or a murderer. The evidence of those who find the body can alone clear up the case; and the medical witness may be required to state how far this evidence is consistent with the situation, extent and direction of the wound by which the deceased has fallen. It would be well if, before a body is moved, a photograph could be taken of the attitude and position of surrounding objects in relation to it.

Evidence from the Wound or Wounds

2. **Suicidal and Accidental Wounds.** It is not often that any difficulty is experienced in distinguishing a *suicidal* from an *accidental* wound. When a wound has been suicidally inflicted, there are generally to be found clear indications of design; and the whole of the circumstances are seldom reconcilable with the supposition of accident. Circumstantial evidence is usually sufficient to show whether a wound has been accidentally received or not; but as an accidental wound may sometimes resemble one of homicidal or suicidal origin, so, if the body has been disturbed, it follows that it is not always possible for a medical witness to decide the question from a mere inspection of the wound.

It would not be difficult to produce instances in which murderers in their defence have alleged that the wounds observed in the bodies of their victims were of accidental origin, and the allegations have been clearly refuted by medical evidence. A witness must be prepared, therefore, in all cases in which death has taken place in secrecy, and the nature of the wound is such as to render its origin doubtful, to be closely examined by counsel for a prisoner charged with homicide on the question whether the wound might not have been accidental. The law requires that it should be rendered evident to a jury, before such a charge can be sustained, that the fatal wound could not have had an accidental or suicidal origin.

The death of a person from wounds has hitherto been considered as a subject connected with a criminal charge; but an investigation of the circumstances in which death ensues is occasionally rendered necessary when the deceased has effected an insurance upon his life. A policy of life insurance is in some cases rendered void by the act of self-destruction; and therefore a person bent on suicide might, for the sake of his family, take precautions to conceal the manner in which he intended to take his own life. His body might be found wounded in a way which would render it uncertain whether he had been wounded accidentally, whether he had been murdered, or whether he had fallen by his own hand. It is incumbent on the insurance office in a disputed case to prove the act of suicide, whereas the relatives of the deceased would attempt to show the contrary. Such litigation must, of course, call forth a searching investigation into all the circumstances connected with the death of the insured, and the whole case would, in some instances, rest almost exclusively on medical evidence.

In September, 1926, a man and his wife were found apparently burnt to death in a motor-car. It was assumed at first that the car had taken fire by accident,, but investigation showed that the man had shot his wife, and had poisoned himself, after which he saturated the car with petrol and set fire to it.

It will greatly aid the effect of medical evidence in reference to the situation and direction of wounds on the body if at the time of inspection a rough diagram of the part wounded is made, and lines are so carried as to indicate by arrows the direction which the weapon is supposed to have taken. A court will thus be able to follow more completely the description given by a medical witness, and to appreciate more readily the reasons which he assigns for his opinion.

3. **Accidental Stabs.** Severe incisions *over* vital parts do not often happen by accident, but severe punctures and stabs affecting vital organs have frequently an accidental origin. These stabs arise generally from falls while the person is in the act of running with a pointed instrument in his hand or his pocket. They are commonly directed from below upwards. Homicidal stabs may be likewise directed from below upwards ; but this is somewhat rare in this country, unless the person is stabbed by an oblique blow while in the recumbent posture. Rules of this kind may appear to be susceptible of but little practical application ; yet cases occasionally present themselves wherein a close attention to situation and direction may materially assist in forming an opinion.

In a murder trial a surgeon deposed that he found, on examining the body of the deceased, a stab on the left side of the chest, near the armpit, about six inches in depth. It had wounded the lung, and had penetrated obliquely into the right auricle of the heart, passing from left to right. He properly stated that, having regard to the situation and direction of this wound, it was very improbable that the deceased could have inflicted it upon himself.

The fact that there may be some instances in which rules of this kind will not be applicable must not prevent the cautious application of them in doubtful cases.

The following cases show how accidental may resemble homicidal stabs :—

A blacksmith, while forging a piece of rod-iron, was irritated at some observations made by a bystander. He made a rush at the offender with the heated iron in his hand, the end being red-hot ; he stumbled and fell. In some way the piece of iron became accidentally reversed ; he fell upon the red-hot point, which struck against a portion of the breast-bone, glanced from that, and penetrated the upper part of the left lung. He died in a few days. If only one person had been present when this circumstance occurred, a charge of murder might easily have arisen, and the medical and circumstantial evidence might have appeared to favour this view. It is difficult to understand how such an occurrence could have taken place by any conceivable accident.

A man was brought to Guy's Hospital with a punctured wound in the back, between his shoulders. It had been inflicted by a stonemason's chisel. The instrument had penetrated to its head, which had prevented it from going further, into the chest, producing a severe wound, as it was supposed, of the lungs, attended with copious hæmorrhage. It appeared that the man had fallen from a blow, but did not complain of being stabbed, and was conveyed home. His wife, on removing his coat, found that his waistcoat and shirt had been penetrated by the chisel, which was still sticking in his back, but the outer coat had not been cut or perforated by it. She withdrew the instrument, when copious bleeding came on, and he was sent to the hospital. It was elicited from witnesses that no weapon was seen in the hands of the accused ; that the chisel belonged to the wounded man, and that he used it in his trade as a stonemason ; there were no marks of blood on the floor where he fell, or on his clothes ; that after leaving the public-house where the quarrel took place he walked with a policeman, who said that the man exhibited no signs of having been wounded, and did not complain of having been struck by the weapon. These facts seemed to show that the stab must have taken place after the quarrel ; it was further proved that the wounded man had the chisel in his pocket before the quarrel, and that, as the outer coat had not been cut, a homicidal stab could only have been inflicted by the assailant's lifting the coat, which was altogether improbable, and then it would remain to be explained how the weapon could have penetrated up to its head.

From the whole of the facts it was considered that this must have been an accidental stab, although its direction was remarkable, since, according to the wife's statement, the weapon had not entered the body in a slanting direction, but straightforward, and it required considerable force to remove it. The man recovered, and from the statement which he made there could be no doubt that it was an accidental stab produced by a fall ; but it was certainly extraordinary that it should have been found in such a situation and taking such a direction. If the wounded person were in a helpless state of intoxication at the time, stabs or punctures might occur of which he might be entirely unconscious. The case further illustrates the importance of examining the clothing. If the act had been homicidal, the coat would have been found perforated.

4. Evidence from the Situation of a Wound. Wounds which result from suicide are generally in *exposed* and easily accessible parts of the body such as the throat and front of the forearm for incised wounds, over the region of the heart for stab wounds, and in the temples, the mouth, or over the heart for firearm wounds.

It is obvious, however, that any of these parts may be selected by a murderer, with the especial design of simulating a suicidal attempt ; therefore the mere situation of a wound does not suffice to establish the fact of suicide. Smith considered, in reference to pistol wounds, that "if the weapon has been introduced into the deceased's mouth, and there discharged, we may take it for granted that it has not been done by another"[1] ; but this inference has been too hastily drawn, because it is quite within the range of possibility that a calculating assassin may purposely resort to this method of killing a person in order to conceal the crime. In suicidal wounds from firearms, a discoloration by powder of the fingers of the hand which discharged the weapon is sometimes observed; this has also been looked upon as a source of evidence of suicide under doubtful circumstances, but a similar objection, although not with equal force, might be made to its admission. Some have regarded it as fully established in legal medicine that when wounds exist at the back part of the body it is a positive proof that they have not been self-inflicted. This situation is certainly unusual in cases of suicide ; but, as Orfila observes, it is not the situation so much as the direction of a wound which furnishes evidence against the presumption of suicide. A wound, traversing the body from behind forwards in a direct line, is not likely to have resulted from a suicidal attempt ; at least, it must be obvious that it would require more preparation and contrivance on the part of a self-murderer so to arrange matters that such a wound should be produced than we can believe him to possess at the moment of attempting his life. An insane person often makes elaborate preparations ; there is, however, usually much general evidence in these cases. Besides, his object is to kill himself as quickly as circumstances will permit; he is, therefore, not likely to adopt uncertain means for carrying this design into execution. Nevertheless we must not always expect to find suicidal wounds in what an anatomist would pronounce to be the most appropriate situation to cause death instantaneously. A lack of knowledge or a lack of resolution on the part of a suicide, or the accidental slipping of the hand, will often cause a wound in a place where we might least expect to find it.

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[1] "For. Med.," p. 302.

Suicidal wounds are sometimes found in the most unusual situations.

The body of an elderly woman was taken to the London Hospital. Although right-handed, she had with a razor held in the left hand made a clean cut across the forearm just below the bend of the elbow, severing a sufficient number of blood vessels to bleed to death; the evidence proved conclusively that this was a case of suicide; she was a woman who habitually had her sleeves rolled up to the elbows.

It is rarely that we find suicidal stabs in the throat, but it is much less common to find them in the abdomen, many such cases having come under our observation. In one attempted suicide a stab was inflicted by a carving-knife on the fore part of the neck, traversing the parts from the windpipe to the spinal column. In regard to situation, there is no wound which a suicide is capable of inflicting upon himself which may not be produced by a murderer; but there are many wounds inflicted by a murderer which, from their situation and other circumstances, could not be self-inflicted.

The situation of a wound sometimes serves to show whether it is of an *accidental* nature or not. Accidental wounds generally exist on those parts of the body which are exposed.

5. **Evidence from the Nature and Extent of a Wound.** Generally speaking, the wound found on the body of a suicide, when firearms have not been used, is either incised or punctured, *i.e.*, a cut or a stab. Contused wounds are rarely seen in cases of suicide, because in producing them there is not that probability of causing death speedily which a self-murderer usually desires. There are, of course, exceptions to this remark, as where, for instance, a man precipitates himself from a considerable height, and is wounded by the fall. Circumstantial evidence will, however, rarely fail to clear up a case of this description. Greater difficulty may exist when death is caused by a contused wound voluntarily inflicted.

A case is related in which a man first attempted to kill himself by running his head against a wall, and not having succeeded in the attempt, he struck himself repeatedly on the forehead with a cleaver. By this he produced such violent injury to the brain that death soon followed. The man was seen by several witnesses to commit the act. If this had not been the case, the nature of the wound was such as to excite suspicion that it had been criminally inflicted by another.

A close attention to the *shape* of a wound in the throat made by a cutting instrument will sometimes lead to a definite conclusion in a case rendered doubtful from the circumstances in which the dead body of a wounded person is found.

The body of a farmer was found lying on a high-road. His throat had been severely cut, and he had evidently died from the bleeding which had taken place. A bloody knife was discovered at some distance from the body, and this, together with the fact that his pockets had been rifled, led to a suspicion of murder. The suspicion was confirmed when the wound in the throat was examined by a surgeon. It was cut, not, as is usual in suicides, by carrying the cutting instrument from before backwards, but in the way in which as the throat of a sheep is cut when slaughtered by a butcher. The knife had been passed in deeply under and below the ear, and had been brought out by a semicircular sweep in front, all the great vessels of the neck, with the gullet and windpipe, having been divided from behind forwards. The nature of this wound rendered it improbable that it could have been self-inflicted, and it further served to detect the murderer, who was soon afterwards discovered. The prisoner, who had been a butcher, was subsequently tried and executed.

In *R.* v. *Cogan* a man was charged with the murder of his wife by cutting her throat. The wound was eight inches long. It began near the centre of the back of the neck on the right side, passed downwards and forwards on this side of the neck across the throat to the middle of the left collar-bone. It was a very deep wound ; it divided the windpipe, all the principal arteries of the neck, as well as the muscles, and even extended to the cervical vertebræ. The deceased probably did not move after being attacked. A bloody razor was found six feet from the body, and there was a pool of blood near this spot, while there were marks on the window-shutter produced by the spurting of blood from arteries. There were fresh cuts upon the left hand of the deceased, such as would be caused by her grasping some sharp instrument. The prisoner was convicted.

The medical witness would not say it was impossible, but he thought it highly improbable that the wound could have been self-inflicted. The prisoner had a slight wound in his throat, and he stated that this had been caused by his wife, who had afterwards killed herself. No blood had been effused at the spot where he said this wound had been inflicted. Such a wound as this could have been produced, if at all, only by the left hand of the deceased ; its situation, direction, and extent, were more consistent with homicide than suicide, and the latter appears to have been clearly negatived by the facts—(1) that the deceased had bled in two places, while death must have been almost instantaneous ; (2) that the weapon was found at a distance from the body ; and (3) that the left hand of deceased was much cut, which could be explained only by the theory that she had endeavoured to protect her throat when attacked.

In the museum of the Sussex County Hospital at Brighton is a " detached portion of a windpipe consisting of parts of the cricoid, thyroid and arytenoid cartilages, with complete circumference of the tube." This was cut out of a woman's throat by an undoubted act of suicide. Dr. F. A. Humphry, who communicated the case, was himself the medical witness in the case ; and he listened to the evidence at the inquest, which proved conclusively that it was suicide. Dr. Humphry found the victim " on her back quite dead with a razor and the piece of trachea by her side."

See also Littlejohn's case (p. 307). in which a woman tore out her thyroid gland and gullet.

When persons suffering from insanity commit suicide, they often inflict upon themselves wounds of an extraordinary kind, such as would, at first view, lead to a suspicion that the wounds had been inflicted by a murderer ; and, therefore, the rules which are here laid down to distinguish homicidal from suicidal wounds must be applied guardedly, in the cases of insane persons.

A case occurred at Guy's Hospital in which a person in a fit of delirium tore away the whole of the abdominal muscles from the lower and fore part of the abdomen. A woman suffering from delirium tremens tore open her abdomen with her hands. The wound produced was eight inches long, and about eight feet of the small intestines protruded from it as well as a portion of the large intestines, which had been completely torn across. She lived twenty-seven hours after inflicting this injury. A pregnant woman under a delusion ripped open her abdomen so that a large wound was made, and the omentum and gravid uterus protruded. A gentleman was found lying in a state of insensibility in the kitchen of his house, with a cleaver by his side. On examining the head upwards of thirty wounds were found over the back part of the skull. The wounds, many of which were superficial, had a horizontal direction from behind forwards. One, however, had removed a portion of the skull from the middle of the lambdoidal suture, so that some of the brain had escaped. This insane person died four days afterwards, but recovered so far as to admit that he had inflicted the wounds on himself, of which, from other circumstances, there could have been no doubt.

Wounds of the Throat, when inflicted by suicides, are commonly at the upper part, involving the hyoid bone and the thyroid cartilages; the large vessels often escape, but the larynx is opened. The wound does not always cause death by hæmorrhage.

A woman, *æt.* 68, attempted suicide by inflicting a wound on her throat. It was between four and five inches long, and extended nearly from ear to ear. It had laid open the larynx between the hyoid bone and thyroid cartilage, and had taken off a portion of the epiglottis. There was no arterial hæmorrhage, only a few veins having been divided.

Ryan met with a case in which a man contrived to cut his throat exactly between the hyoid bone and the larynx, having previously made two distinct cuts of the thyroid cartilage. The wound was of an unusual kind, reaching backwards through the pharynx to the spinal column. There were two cuts on the fourth cervical vertebra and another on the intervertebral cartilage. The carotids and jugulars had escaped, but some of the larger branches of those vessels were divided. The man survived about seven hours.

The *extent* of a wound, by which we are to understand the number and importance of the parts injured, must in these cases be always taken into consideration. It has been somewhat hastily laid down as a rule that an extensive wound of the throat, involving all the vessels and soft parts of the neck to the spine, could not be inflicted by a suicide. Although in general suicidal wounds of this part of the body do not reach far back, or involve the vessels of more than one side, yet we find occasionally that all the soft parts are thus completely divided. These are cases in which, perhaps, with a firm hand, there is a most determined purpose of self-destruction. In a case of suicide observed by Marc, the weapon had divided all the muscles of the neck, the windpipe, and gullet; it had severed the jugular veins and both carotid arteries; and had even grazed the anterior ligaments of the spine. A wound so extensive as this is rarely seen in a case of suicide; but there is no ground for the assertion that extensive wounds in the throat are incompatible with self-murder.

In a case of suicide (witnessed by three fellow-workmen) there was one tentative cut on the left, just incising the skin, and the fatal wound was very deep. It had divided both sternomastoids, the left common carotid artery and internal jugular vein, cleanly severed the upper part of thyroid cartilage above the false vocal cords, passed through the base of the arytenoids, cleanly divided the œsophagus, cut through the longus colli on the left side, and notched an intervertebral disc. On the right it had opened the carotid sheath, but had left the vessels intact.

Incised wounds in the throat are generally set down as presumptive of suicide; but a murderer sometimes wounds this part with a view to concealing his crime. Circumstances connected with the form and direction of a wound may in such cases lead to detection; for, unless the person attacked be asleep or intoxicated, resistance may be offered, evidence of which may be obtained by the presence of great irregularity in the wound or the marks of other wounds on the hands and on the person of the deceased. In some instances, however, it is extremely difficult to state positively whether the wound is homicidal or suicidal. *Regularity* in a wound of the throat has been considered to be presumptive of suicide ; but as a general principle this appears to be a fallacious criterion, inasmuch as a murderer by surprising his victim from behind, or by having others at hand to assist him, or by attacking a person who is asleep, intoxicated, or from age or infirmity incapable of offering resistance, may easily produce a regular and clean incision of the throat.

A woman was brought into the London Hospital with her throat cut by homicidal violence. The edge of the wound was as straight and clean cut as though done for the purpose of illustrating how straight a cut could be made.

Some writers, on the other hand, have contended that the chief feature of a suicidal wound in the throat is great irregularity caused by lack of steadiness in the hand during the act of suicide. It is by no means unusual in a suicide to find the cut regular at its commencement, and irregular or uneven at its termination, in consequence of the loss of blood which attends the first incision ; but it is obvious that a homicidal wound might possess these features. Regularity or irregularity in an incision in the throat furnishes no presumptive evidence either of homicide or suicide.

The depth to which a suicide can cut his own throat is often a matter of wonder ; but there are limits to it, of which the following is an example :

In *R.* v. *Edmunds* a young woman was found dead with her throat cut and a razor taken from the house was lying near the body. There were three distinct and deeply incised wounds in the neck made from left to right, the upper one, four inches in length, commencing below the left ear, and running parallel to the jawbone ; the middle cut, about seven inches in length, commencing at the same point, and running across the middle of the neck to a spot behind and below the right ear ; and the lower cut, six inches in length, commencing above the middle of the left collar-bone, going in a perpendicular direction, and terminating in the front of the neck by joining the middle incision. The middle cut divided the windpipe, the gullet, and all the great vessels and nerves in front of the neck to the cervical vertebra. There were two distinct cuts into the spinal column about the third cervical vertebra, one penetrating deeply into the upper edge of the bone, and the other, a quarter of an inch below it, commencing on the body of the vertebra and running more deeply to the right side. This divided the transverse process of the vertebra, opened the joint between it and the bone, and severed the vertebral artery. There were deep cuts, which had bled, on the inside and outside of the left hand ; and the pad of the middle finger of the right hand had been sliced off, and was found wedged in the joint of the razor. There was no blood upon the handle, while the hands of the deceased were bloody.

It is scarcely necessary to adduce reasons for showing that these wounds could not have been inflicted by the deceased upon herself. Apart from all the surrounding circumstances, and looking at the medical description only, of the situation, nature, extent, and direction, the surgeon was quite justified in saying that " it was impossible for any person to inflict such wounds upon himself." The hacking of the bones of the spinal column in *two distinct places* with such force as to cut off a part of the bone, after both carotid arteries and jugular veins had been cut through, was alone sufficient to justify this opinion. In order to produce these marks, the razor must have been obviously twice used with great force through the same deep incision. There could be no reasonable doubt that this was an act of deliberate murder; but there was a failure of proof to trace it to the accused. A suicide may graze the ligaments in front of the spinal column; but that he should make deep incisions into the bones, cut off hard bony processes, and divide the intervertebral substance and the vertebral arteries is a proposition contrary to all experience and probability.

Kerr[1] reports a case of suicidal cut throat in which the left transverse process of the fifth cervical vertebra had been cut through, and was found lying free in the incised tissues.

In *R.* v. *Deakin*,[2] the medical evidence was so important, and the judge's criticisms so interesting, that they are quoted in full. The defence was of suicide, but the prisoner was convicted of murder.

Dr. W. Horton Smith said he was called to the scene of the tragedy on 26th January, and found the body of the deceased. The left arm lay across the chest, the hand holding a large knife loosely. There was a wound in the neck reaching almost from ear to ear, six inches in length, and the result of two incisions. One incision had first been made on the left side, and the knife had been introduced into the wound again, almost to the bottom of the first incision, and another incision had then been made, passing almost directly upwards to the back of the mouth. The wound was evidently made from left to right. There were indications of other attempts on the throat. On the thumb of the left hand there was a slight wound, a very deep wound between the thumb and first finger. There were other cuts on the left and right hands. The throat wounds could not have been self-inflicted. If they had been, he would have expected to find the knife firmly gripped in the right hand, and the wounds transverse, and not tending upwards.

Cross-examined: He did not remember saying at the inquest that it was conceivable the wounds might have been self-inflicted. When confronted with his written evidence, the witness admitted his signature, but he could not remember making that statement. It was a fact that suicidal wounds varied more than any others. Whichever of the throat wounds was first inflicted, unconsciousness would have supervened, and it would have been impossible to inflict a second.

Dr. Marsh deposed to making a *post-mortem* examination of the body. The wounds on the throat had been made by two distinct incisions. The first divided all the structures down to the bone, and cut a groove in the bone. The second went in a higher direction, and divided the deep structures up to the root of the tongue. The reason why he said there had been two incisions was that the main artery on the left side had been divided twice. The first incision, which was the lowest, cut the main artery across: the second incision, which was higher, also cut the artery across.

His Lordship: We all agree there were two incisions. The point is, why do you speak of one incision as being prior in time to the other? How do you ascertain which incision was the earlier?—Witness: The first incision, which is the lower of the two, cut through the skin and the windpipe and the gullet. Having been cut through, they would retract, be drawn downwards and upwards, so that these structures were not divided by the second incision. The second incision missed them. There was nothing divided twice but the artery. The division of the windpipe being in a line with the lowest of the two incisions, and with the groove in the bone, it necessarily follows that the other incision must have been second to it, otherwise the windpipe must have been divided higher. It is impossible for the wounds in the neck to have been self-inflicted.

Cross-examined by Mr. Trevor Lloyd: When before the coroner, did you say, "I think it is exceedingly improbable that both wounds could have been self-inflicted; I cannot say that they have not been self-inflicted"?—Witness: Yes, but that is not quite the same thing.

You did not say it was impossible?—I said it was exceedingly improbable.

But you said, "I cannot say they have not been self-inflicted"?—No, I can only say it is improbable.

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[1] Kerr, D. J. A., *Brit. Med. J.* 2: 1042, 1924.

[2] Chester Assizes, June 1894.

His Lordship: But to-day you said "impossible," and you understand "impossible" and "improbable" are not quite the same thing. Is "improbable" right and "impossible" wrong, or *vice versâ* ?—Impossible, considering the two wounds.

Why did you say "improbable" only before the coroner ?—We were mixed up between one and two wounds. The fact was not clearly brought forward that there were two wounds.

Then with regard to one wound, you say it is improbable, but possible, that one wound was self-inflicted ?—Yes, but I said both wounds to-day.

By Mr. Lloyd: I admit the first wound might have been self-inflicted.

Frank Thomas Paul was examined at some length. The throat wounds, he declared, were certainly not self-inflicted. Either of them would have been rapidly fatal. Many of the deep tissues were divided into two parts. That was quite sufficient to decide that the wounds were made in two cuts. In witness's opinion, neither of the wounds was self-inflicted. Speaking of the lower cut by itself, if that had been the only one his reasons for saying that such a cut was homicidal rather than suicidal were—(1) the size of the wound, and (2) that the deep tissues were cut further than the skin. These reasons were applicable only to the hypothesis of only one cut on the neck, and without regard to the other wounds on the hands, etc.

His Lordship: How a wound on the hands can affect the view regarding a wound on the neck passes my comprehension.—Witness: All authorities on medical jurisprudence consider them of the utmost importance. We cannot judge a single cut by itself. Medical men, any more than courts, don't come to a conclusion on one point alone. Here is a wound which might have been either homicidal or suicidal if you take one alone.

His Lordship: Really I must ask you to bear in mind you have nothing to do with the issue of this case. You come here to give scientific evidence, and if a hypothesis is placed before you, you must answer on that hypothesis.—Witness: I was trying to answer in such a way as not to mislead you.

Examination continued: Witness said it was, in his opinion, impossible for a suicide to inflict the second wound, which was an upper cut, because the second wound commenced in the first cut. The effect of the first cut upon the victim would render her almost immediately unconscious. The wound was so deep upwards as to be almost unknown in cases of suicide. Witness never heard of a wound being in an upward direction in throat wounds of this kind. The throat wounds were unquestionably from left to right. Such a wound, if suicidal, must be cut with the right hand. The other small cuts and scorings on the neck were quite different from the tentative wounds caused by a suicide in making up his mind to cut his throat. They rather resembled the wounds made when the assailed was trying to escape the assailant's knife. The cuts on the hands showed several attempts to grasp the blade of the knife.

Cross-examined: Suicidal wounds varied more than any other in direction and extent. It was not a fact that a maniac would often cut upwards, but it was stated in some books that maniacs might cut upwards. It was always regarded as a sign of homicide when the wounds were upwards. A maniac would cut in almost any direction. It was a fact that a suicide sometimes dropped his weapon; he either gripped or dropped it.

The nature and extent of a wound, or of other injuries on the person will sometimes allow us to distinguish accident from homicide. These personal injuries may be such that they could not possibly have had a suicidal or accidental origin. In a case tried at Manchester it was shown that seven ribs were fractured on one side of the chest of the deceased, and five on the other. The person charged with murder alleged in defence that he had merely struck the deceased a slight blow, and that the ribs were subsequently broken by an accidental fall. The medical witness, however, satisfied the court that the fall, as described by the prisoner, was inadequate to the production of such extensive violence; and that, even had the deceased fallen on *one* side, this would not account for the fracture of the ribs on the *other*. When, therefore, we find in a dead body severe injuries referred to a fall, we should search the whole of the body carefully for proofs of violence. The insides of the arms or thighs may present marks of injury which could not possibly be explained on the supposition of accidental fall. Severe contusions on both sides of the body, or anteriorly and posteriorly, commonly indicate homicidal violence.

The body of a woman alleged to have been murdered by her husband presented numerous marks of contusions, and one arm was deeply bruised from the shoulder to the hand. The person charged with the murder ascribed these appearances to the fact of his wife having accidentally fallen out of bed; but on examining the bed it was found to be only a foot from the floor. A fall from this height would not account for the presence of such extensive marks of violence; but, irrespective of this, a severe contusion was found on the outer side of the opposite thigh, which, from the appearance, must have been produced about the same time as that on the arm. The existence of this second contusion rendered the defence still less probable; for the woman could not, if she had fallen at all, have fallen on both sides of her body at once, and it was not alleged that she had more than one fall.

Medical evidence regarding the nature, probable origin, and date of any wounds found on a child who may be unwilling or unable to give evidence may be of the utmost importance in deciding the question "Accident or Intent?"

In the trial of Mrs. Day at the Exeter Assizes, a physician said that he had examined the child on two occasions, the first being August 4th, a week before her removal from her mother. She then appeared to be frightened. He found marks upon her hands and arms consistent with her story that her mother had cut her arms, had scratched her hands, and had bitten one of her fingers, also marks consistent with her story that her hand had been burned by her mother. There were twelve marks on her right hand and arm and eleven on the left, a condition which in itself could hardly be accounted for by the explanation of the defence that she was a clumsy child and given to hurting herself accidentally.[1]

6. **Evidence from the Direction of a Wound.** The direction of a wound may be of value in investigating a case. In most suicidal wounds inflicted upon the throat the direction of the cut is commonly from left to right, either transversely or more often passing obliquely from above downwards; in suicidal stabs and punctured wounds, the direction is commonly from right to left, and from above downwards. In left-handed persons the direction would, of course, be in the opposite transverse directions. Suicidal wounds are, however, subject to such variation in extent and direction that it is scarcely possible to generalise with respect to them. Nevertheless, an attention to these matters may sometimes be of real assistance to the inquirer, especially when the body has not been moved from the position in which it was found. If a murderer makes an incised wound in the front of the throat from behind, the direction may be the same as that commonly observed in cases of suicide. Again, if the person attacked is powerless, the wound may be deliberately made so as to resemble a suicidal act; indeed, a murderer may attack the throat with the intention of making it appear to be an act of suicide. A homicidal stab may also take the same direction as one which is suicidal, but this would be confined to those cases in which the assailant was placed behind or alongside. If in front of the person whom he attacks, the direction

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[1] *Lancet*, 1903, 2, p. 1254.

would probably be from left to right; but in suicides, when the right hand is commonly used, it is the reverse. Oblique wounds passing from above downwards are common to homicide and suicide, but those which take an oblique course from below upwards are generally indicative of homicide, for it is extremely rare that a person bent on suicide, unless a lunatic, thus uses a weapon. Homicidal incisions, especially in the throat, are often prolonged below and behind the skin forming the angles of a wound (undercut is the common term) deep into the soft parts. Those which are suicidal rarely possess this nature; they terminate gradually in a sharp angle, and the skin itself is the furthest point wounded. The weapon is not carried behind, below, or beneath it. Exceptions to these features may exist. The instrument with which a wound is supposed to have been inflicted should be adapted to the edges of the incision, its sharpness compared with the cleanness and evenness of the cut, and its length with the depth of the incision or stab. It is no uncommon occurrence for a murderer to substitute some instrument belonging to the deceased or another person for that which he has actually employed; and this by its size, shape, bluntness, or other peculiarities, may not account for the appearances presented by the wound.

The *end* of an incised wound in the throat is often digitated, owing to the skin being dragged forward in folds by the cutting instrument; and when recent the minute saw-like serrations of the skin point towards the commencement of the wound.

If, by examining the ends of a wound, it becomes possible to decide whether it was inflicted from right to left, or *vice versâ*, it is then sometimes possible to say which hand was used by a suicide, or, if the relative position of the parties is known, by a murderer, a point which may have an important bearing, if either of them be known to be only right- or left-handed. It is necessary, however, for a medical jurist to be aware that there are many persons who are *ambidextrous*, *i.e.*, who have equal facility in the use of the right and of the left hand. This may not be generally known to the friends of the deceased; and such persons are often pronounced, even by those who had associated with them, to have been right-handed. A want of attention to this point is said to have been one of the circumstances which led to a suspicion of murder in the case of Sellis.[1]

This man was found dead on his bed with his throat cut, the razor being on the left side of the bed, whereas it was generally supposed and asserted that he was a right-handed man. The truth was, he was equally expert in the use of the razor with his left and with his right hand; and thus the suspicious circumstances of the razor being found on his left side was at once explained away.

A case of suicide by cut throat occurred in London which shows the necessity for caution in forming an opinion in these cases. A man, known to be right-handed, was found dead with his throat cut; it proved to be what is called a "left-handed cut," *i.e.*, done with the left hand. It appeared in evidence that deceased was brought up as a woodcarver, a trade which requires a man to use both hands equally well. Thus the cause of the wound being in an unusual direction for a right-handed man was satisfactorily explained.

The direction in which a wound has been made may not infrequently be determined by the serrated character of the edges. The points of these serrations are directed towards the commencement of the wound. If, after the wounding, the person lives more than two or three days, these serrations may disappear. In cases of cut throat the existence of **small tentative cuts** near the commencement of the main cut affords aid in diagnosis. If these are fairly parallel with the chief wound, the presumption afforded by this evidence is that the wounds are suicidal; but if the tentative wounds are different in direction from the principal wound, this points rather to homicide than suicide, and may be referred to the attempts by struggling to evade the assassin's knife.

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[1] Wills's "Circ. Evidence," p. 97.

Sometimes all the information derived from the depth and direction of the wound is insufficient to enable a medical witness to state whether it is certainly due to either suicide or murder, though in most cases a probability may be arrived at.

However indecisive the indications may be from the direction of incised wounds, those from the **direction of stabs** give precise information as to the position of the weapon at the time the wound was made, and therefore of the position of the assailant's arm; and still further deductions may often be drawn as to the relative positions of the parties, points which may be of no absolute and positive value in themselves, but are very important in corroboration or contradiction of the story of the accused person.

In *R.* v. *Carver* the prisoner was charged with the murder of his wife by stabbing her in the chest with a knife. The wound was between the fourth and fifth ribs of the left side. It was four inches deep, and had penetrated to the heart. It caused death in two or three minutes. The defence was that the deceased rushed at the prisoner while he was holding the knife in his hand. The direction of the wound was described as straight or transverse, and the surgeon thought it might have been caused by the woman rushing on the knife in the manner described. As to the precise direction of the wound, the witness said it was rather upwards towards the heart. There were other marks of violence about the deceased, showing that she had been ill-treated, and there was evidence of the prisoner having been seen to strike her about the time at which she was wounded. Upon this evidence he was convicted.

A remarkable case, involving a similar question, was *R.* v. *Davy*. The prisoner was charged with the manslaughter of Mr. Moon under the following circumstances: A fall was heard in the dining-room, and on persons going in they found the deceased on the floor dying from a wound in his chest. The prisoner said: "I am afraid I did it, but I don't know how; it must have been done in the scuffle." A large table-knife, taken from the knife-box in the sideboard, had been removed from the wound, and was lying within the fender. The defence at the trial turned mainly on this medical question: "Was the wound such as might have resulted from accident during a scuffle, or did it carry with it clear and undoubted proofs of design?" The wound penetrated the left side of the chest between the sixth and seventh ribs, reaching and wounding the apex of the heart, and was downwards, forwards, and inwards in one uniform direction, straight from end to end, never changing its course. The obliquity of the ribs allowed of its reaching the apex of the heart. There was not the slightest upward tendency in the direction of the wound. The opinion of Savory was "that the wound must have been inflicted by another person stabbing the deceased, and that it was caused by one blow given with considerable force." He could not suggest any theory satisfactory to himself by which the wound could have been caused accidentally. Other surgeons gave evidence to the same effect.

Savory believed it was impossible that the body of Moon had fallen on the knife and so inflicted the wound. He could not account for the wound in that way. He would not swear unconditionally that it was impossible, because his judgment might err, but he believed it to be impossible, and he said, the wound being from above downwards, the pressure must have come from above, whereas in the case of a falling body the pressure would come from below. For the defence four surgeons were called, who thought the wound might have been caused by the deceased in pulling down the knife upon himself during a struggle with the prisoner.

One believed that the knife might have been driven into the apex of the heart by a fall. An appeal to the jury to acquit the prisoner on the ground of the conflicting opinions expressed in the case and the difficulty which the jury must necessarily experience in finding a verdict of guilty failed.

When a medical witness has admitted that the wound may have been self-inflicted he has gone as far as professional knowledge will permit. The question of probability must be solved, if at all, by the other circumstances of the case.

At Douglas, Isle of Man, a man was put on his trial for murdering his wife. Medical evidence proved that the fatal wound had penetrated the left side of the chest close to the sternum in the third intercostal space. Close to the sternum the wound was deep, and had cut the pulmonary artery. Farther away the wound became shallower, ending as a mere skin incision. The prisoner alleged that he was cutting his nails with a sharp penknife (the admitted weapon), and that, as his wife aggravated him, he had pushed her away with his hand containing the knife and brought his hand round in a sweep. The wound precisely corresponded with such an explanation, and led to the acquittal of the prisoner.

7. **Evidence from a Multiplicity of Wounds.** It is obvious that much will here depend upon the nature of the multiple wounds and their situation. For instance, wounds found on the hands in conjunction with a fatal cut in the throat or a stab are strongly presumptive of homicide, the hands being wounded in attempts at defence.

In *R.* v. *Gardner*, this question was of considerable importance. Without going minutely into details, it may be stated that Sequeira, the surgeon who was called, found the woman dead, and blood was copiously effused, but only on each side of the neck, not in front of her person. A large table-knife was loosely placed in her right hand; it was lying in the direction of the length of the body, the back of the blade towards the chest, and the sharp edge in front. There was dry blood upon the blade and handle. The body was lying at full length in a corner by an open door as if laid out, the right arm, which held the knife, being partly under a bed. The wound in the throat cut through the bone and thyroid cartilage of the larynx, dividing the thyroid artery, causing a flow of blood and death by suffocation. It commenced over the larynx as by a deep stab, and extended for about two inches downwards and backwards on the left side. It must have been inflicted while the deceased was lying down, and in the circumstances it was not such a wound, in the opinion of the medical witnesses, as a woman could have inflicted on herself while in this position.

The palms of the hands of the deceased presented numerous fresh cuts. The sharp blade of the knife had probably been grasped by the deceased before her death in resisting the attack. There were four cuts on the left hand and six on the right. Some of the cuts were across the fingers. Of two on the middle finger of the left hand one had gone completely through to the bone.

The knife was lying *loosely* in the right hand of the deceased, and the small quantity of blood on the palms presented the appearance of smearing or wiping. On these facts being proved, it became simply a question which of two persons then in the house was guilty of this act of murder. The husband was convicted of the crime.

In homicidal wounds of the throat, the hands of the deceased, either back or front, frequently present marks of recent cuts.

These injuries arise from an instinctive effort to protect the throat under a sudden attack. It need hardly be said that a person contemplating self-destruction by wounding the throat would not begin by making cuts across the hands. Sometimes the weapon may be so grasped by the person attacked as to cause numerous cuts on the front of the hand. These will, of course, bear the characters of recent cuts. Their presence should admit of some reasonable explanation. In *R.* v. *Gardner.* this was one of those facts properly considered to be inconsistent with the innocence of the prisoner.

In suicides, commonly one wound only is seen—namely, that which has caused death—and the presence of several wounds on the body or the marks of several attempts around the principal wound have been considered to furnish presumptive evidence of murder. But any inferences of this kind must be cautiously drawn, since not only may a murderer destroy his victim by one wound, but a suicide may inflict many, or leave the marks of several attempts before he succeeds in his purpose.

A case is reported in which a man, suffering from mania, attempted to destroy himself. Besides many wounds on the forearm, neck and face, which disfigured him, there were twenty-two in front of his chest. One of these had traversed the heart, producing death after some hours by causing effusion of blood.

In wounds of the throat, owing either to ignorance of the situation of vital parts or to tremulousness of the hand, a suicide often produces one or more incisions of greater or less extent near that which has destroyed life. This is especially the case when the instrument happens to lodge in the first instance on the cartilages of the larynx. The same remark applies to suicidal stabs when the point of a weapon, in being directed against the chest, comes first in contact with the ribs or their cartilages. With respect to the throat, many cases might be cited in which two, three, and even six or more incisions have been made in this part by suicides before they have succeeded in destroying themselves.

A medical man killed himself by inflicting several wounds on his throat. An incision was found on each side of the neck, just below the angle of the jaw, and in the hollow behind it. The wounds were irregular in form, and bore the nature of deep stabs. The only important vessel divided was the internal jugular vein on the right side ; but nevertheless a large quantity of blood was lost, and this was no doubt the cause of death.

The case is singular in many points of view, for such wounds have perhaps never before been described in cases of suicide. It would appear that the deceased was ambidextrous, and that the wound on each side of the neck was inflicted by the hand of the opposite side.

The *number* and *nature* of the wounds may lead to a strong suspicion of murder.

A woman, *æt.* 60, was one morning found dead with severe wounds on the back and front of her neck. She was seen alive three-quarters of an hour before, and the only person in the house was her husband, an aged, feeble man. A large table-knife newly sharpened was found near the body. When examined by Lucas, the following injuries were observed : In front there was an incised wound across the throat, four inches long, from about half an inch on the right side of the middle line towards the left ear, dividing the large muscles on the left side of the neck, and the left internal jugular vein, which was gaping. The mark of the cutting instrument was very distinct on the cartilages of the neck, extending rather obliquely down from right to left. On the back of the neck there was a deep gaping wound, extending horizontally from the right ear to the angle of the jaw on the left side, passing down between the third and fourth vertebræ, laying the spinal marrow bare ; there was a slight abrasion on the surface of the cord, which might have been accidentally produced during the examination. A second cut was found passing between the second and third vertebræ, also extending to the spinal cord. The skin showed marks of several incisions, the muscles being mangled by repeated cuttings ;

the edges of the bones were rough, and one slice of bone about the size of a shilling lay almost detached in the wound. The wound in front was separated from the one behind by about half an inch of skin. There were no marks of violence on the hands or on any other part of the body.

The evidence at the inquest proved that the son had left the house before the time of the woman's death, and that she had spoken to the neighbours and her husband in a desponding manner a few days before the event. The evidence was generally in favour of the deed being suicidal. It was satisfactorily established that the husband and wife had lived on good terms, and no motive for his perpetrating such an act could be suggested. A verdict of " Wilful murder against some person unknown " was returned. These wounds might have been inflicted by the deceased on herself with her left hand, probably in an attempt to cut off her head. The wounds at the back of the neck were inflicted first, while the principal wound—that which proved fatal by the division of the jugular vein—was inflicted last. The woman had been for some time in a despondent state, and on the evening before the event she had been observed by her husband to pass a knife with her left hand across the back of her neck, as if she was contemplating suicide. There was not the slightest proof of homicide.

The *number*, *situation* and *direction* of the wounds found on a dead body may be inconsistent with the theory of a suicidal origin.

A woman was found dead in New York and there were many wounds upon her body. The husband asserted that she had killed herself. This defence, however, was shown to be inconsistent with the medical facts. Three physicians who examined the body deposed that there were eleven stabs, eight on and about the left side of the thorax, one of which had penetrated the pericardium and divided the trunk of the pulmonary artery at its origin; and the others were on the back, near the left scapula. It was stated that it was impossible that these last-mentioned wounds could have been produced by the deceased, and there was every reason to suppose that the stabs in front and at the back had been inflicted at the same time by an assassin

In acts of murder perpetrated by insane persons it is usual to find a large number of wounds on the body of the person attacked.

In a case at York, a man in a fit of delirium tremens killed his wife by cutting and stabbing her. There were fifty-six wounds, some of which were of a nature inconsistent with the theory of self-infliction.

Kerr has described a case of suicide in which he counted 440 separate incised wounds over the front of the body.

In examining a dead body, attention should be paid to the state of the **mouth and throat.** Assailants who make their attack while their victim is asleep sometimes endeavour to close the mouth, or to compress the throat, so as to prevent an alarm from being given. In the case of the Duchess de Praslin, there were the marks of fingernails around the mouth. In another case, ecchymosed impressions, as if produced by a hand, were found upon the throat of the deceased.

Two or more Mortal Wounds. When we find several wounds on the body of a suicide, it generally happens that one only is of a *mortal* nature, namely, that which has caused death. On this account it has been asserted by some medical jurists that when two mortal wounds are found upon a body, and particularly if one of them is of a stunning or stupefying nature (*i.e.*, affecting the head), they must be considered incompatible with suicide. An inference of this kind can be applied to those cases only in which the two wounds, existing on different parts of the body, were likely to prove immediately fatal. It must, however, be borne in mind that all suicides do not *immediately* perish from wounds which are commonly termed mortal; on the contrary, they have often the power to perform acts of volition and locomotion, which might by some be deemed wholly incompatible with their condition. It is difficult to say whether one wound was likely to cause death so rapidly as to render it impossible for the person to have inflicted another wound upon himself; but when there are several distinct incisions on the throat, each involving important blood vessels, there is a strong suggestion that they were criminally inflicted. There are no rules by which, in unknown cases, the instantaneous mortality of wounds can be accurately determined—a fact which is apparent from a description of wounds of the head, heart and throat.

It is not possible to say, from the mere discovery of marks of contusion or injury on the head, that the deceased must have necessarily suffered from insensibility or concussion, and have therefore been afterwards unable to inflict any wound upon himself. Injuries of the head are accompanied by singular anomalies in this respect. One person will be rendered insensible and powerless by a blow which may leave scarcely any appreciable marks; whereas another will be able to walk and exert himself after the skull has been fractured and depressed, blood effused, and even when a portion of brain has been lost; in short, the appearances may be such as to induce many surgeons to express an opinion that death must have taken place instantaneously. A medical witness should be fully prepared for the occurrence of such anomalous cases; but a strong suspicion of homicide may fairly arise when, in addition to there being marks of great injury to the head, a severe cut or stab is found on the body. A man is not likely to cut or stab himself after having sustained severe violence to the head; but he may retain the power of precipitating himself from an elevated spot, and thereby of producing great injury to the head, after having previously attempted to cut his throat or stab himself.

A man was found lying dead in a street in a low quarter of London with his skull severely fractured and his throat cut. The evidence adduced at the inquest satisfactorily showed that the deceased had attempted suicide by cutting his throat in his bedroom, and had then thrown himself out of the window, by which the fracture and other severe contusions had been produced.

If his body had been discovered in a lonely and sequestered spot, the medical presumption would probably have been one of murder. A similar observation may be made in regard to the following case:—

A man stabbed himself in the chest with a sharp instrument like a dagger, and then threw himself from a window forty feet from the ground. On examining his body the weapon was found sticking in the wound. It had penetrated the chest to the depth of six inches.

Cases of this description are usually determined by circumstantial evidence.

In *R.* v. *Corder*, a woman was found dead nearly twelve months after she was first missed. Her body was clearly identified. A handkerchief was drawn tightly around her neck, and a wound from a pistol-shot was traced through the left side of her head, passing out at the right orbit; three other wounds were found, one of which had entered the heart, and all of which had been made with a sharp instrument. The prisoner charged with the crime alleged that the deceased had committed suicide; but the variety of the means and the instruments employed to cause death as well as the fact that the bullet wound in the head, the stab in the heart, and the act of strangulation were individually sufficient to account for speedy death, left no doubt that this was an act of murder.

In *R.* v. *Cass*, a young woman was found in a farmhouse dead from a wound in her throat. This wound was seven inches long and two inches in depth; it was situated on the left side of the neck; its direction was nearly transverse, but passing slightly upwards from behind forwards. The incision commenced a little in front of the spine on the left side opposite to the second or third spinal process and terminated about an inch and a half from the centre of the chin, the fore part of the incision being *over* the body of the lower jaw and quite superficial, dividing only the skin, cellular tissue, and fat. The important parts involved on the left side were the external and internal carotids, which were cut into but not across; the internal jugular vein, the pneumogastric nerve, and *the spinal cord*, were completely severed. The weapon entered the joint between the second and third cervical vertebræ, about two-thirds of the intervertebral substance between these bones having been divided. A portion of the second vertebræ had been cut through, and was *left adherent to the lower lip of the wound.* The left vertebral artery was also completely divided. The lower lip of the wound was jagged and serrated, and the neck was slightly wounded lower down on the same side, showing that several strokes had been made in this part with the weapon. In the *left* hand of deceased a common dinner knife was found, loosely *held:* it was in a reversed position, with the back instead of the edge towards the throat. The left hand presented three incised wounds over the middle finger, one of considerable depth, and another reaching to the bone over the outer side of the ring finger. The right hand had only one slight wound upon it. The deceased was *right-handed.*

A wound of this kind was inconsistent with suicide. Assuming that it had begun behind, the spinal marrow was divided in such a way that there would be instantaneous destruction of all muscular power, so that the weapon could not be carried forward to the division of the jugular vein and the two principal branches of the carotid artery in front. Assuming that the wound had commenced in front, the division of these large vessels would have rendered it impossible, by reason of the copious loss of blood, to have carried the weapon through the intervertebral substance to the division of the spinal marrow and vertebral artery behind. It was clear that the wound had begun behind on the left side, and that the weapon was used with great force to cause a division of the bony process of the second vertebra. Its situation, extent, and direction were all inconsistent with suicide. A suicide could have inflicted a wound in this situation and direction only with the right hand, but the weapon was lying loosely in the *left* hand of the deceased. There were deep recent cuts on the back of the left hand which admitted of explanation only on the supposition that the deceased had raised it to protect her throat. No suicide scores the backs of the hands before inflicting fatal wounds on the throat. A fellow-servant of the deceased, although not at first suspected, was tried, and convicted of this act of murder upon his own confession. His clothes were examined, and it is worthy of observation that, with the exception of a few small spots on the shirt, they were free from any marks of blood. The knife found in the hand of the deceased was bent towards the end as if it had been used against some hard obstacle. It had been wiped; but it still contained in its depressions and irregularities, as well as between the layers of the handle, coagula of recent blood mixed with rust. In a small coagulum found on the knife, dried and fixed to the blade, were some woollen fibres of a peculiar purple-brown colour. These corresponded exactly to the fibres of the woollen jacket which the prisoner wore. This observation was of great importance in connecting the accused with the crime.

The dead body of a woman was found at the foot of some stairs in Bethnal Green. There was no implement about that could have caused the injuries, neither was there any broken glass nor crockery ; nor again, were there any projecting articles in the banisters which could have caused them if the deceased had fallen and injured herself. There were no less than eighteen wounds about the head and neck, thus described by the physicians who performed the autopsy :

1 and 2. An old bruise on right temple, and one on centre of forehead.

3. About the left ear, an incised wound from right to left, one and a half inches in length, dividing all structures down to bone, including posterior branch of temporal artery.

4. Another commencing above left ear, passing upwards and forwards from left to right, two inches in length, clean cut and deep, dividing branch of temporal artery.

5. On the top of forehead and to the left, a three quarters of an inch clean cut from above downwards.

6. Lower down the forehead and on the left side, a gaping wound, one and a quarter inches in length, with bruised edges, laying bare the skull.

7. Outer side of left eyebrow, cutting from below upwards, a deep, clean-cut wound, one and a quarter inches in length.

8. A clean-cut wound, one inch in length, penetrating the orbital cavity and chipping a piece off the bone at the external angular process (left side), upper angle of wound bifurcated.

9. A mere scratch across the upper left eyelid.

10. A clean-cut gaping wound of the lower eyelid, commencing at the inner canthus, and passing outwards for one and three-eighths of an inch, ending in a scratch.

11, 12, 13, 14. Four deep scratches under lower lid.

15. About centre of left cheek, a three quarter of an inch clean cut, running upwards or downwards, almost parallel with the lower jawbone, cutting through the skin only.

16. On the lower edge of chin, a similar wound.

17. A deep lacerated wound, three quarters of an inch in length, just above the free margin of upper lip, running from middle line downwards and outwards to left, not penetrating to inner mucous surface.

18. A very large wound, lacerated and gaping widely, from septum of nose downwards and outwards to the left angle of lip—edges bruised—soft structures covering the upper jaw ploughed up very deep ; length of wound, two and one-eighth inches.

Upper jaw comminuted, malar bone broken, nose broken, some teeth missing from jaw ; face not swollen.

Wound No. 3 was alone enough to have caused death, and if Nos. 4 and 6 were compatible with and even suggestive of a hard blow with a blunt instrument, No. 18 had certainly been given by a blunt instrument, the remainder might have been given with a sharp instrument, and No. 8 was as if produced by a thrust with a sharp chisel or similar weapon.

In regard to any given individual wound, there was no impossibility of its being inflicted accidentally, or even suicidally, but when the number and position of all of them were taken into consideration, it was impossible that the case could have been either suicidal or accidental, and a verdict of murder against an unknown person was returned by the coroner's jury ; beyond this the case never went.

When several wounds are found on a dead body, the question is frequently asked, **Which was first received** ? If one is what is commonly termed mortal, and the others not, it is probable that the latter were first inflicted. This remark applies both to cases of homicide and suicide ; but it is apparent that when in a murderous assault, a person has been attacked by several assailants at once, the wounds may have been simultaneously produced. This is, however, a question to which it is not easy to give a specific answer. Each case must be decided from the special circumstances attending it; and in most instances, unless some direct evidence is forthcoming, a medical opinion can be little more than conjectural. This question is almost always put in a court of law, and a witness should at least prepare himself to meet it by a proper examination of the medical circumstances of the case.

On the body of a girl brought into London Hospital there were two wounds, one of which had penetrated the heart and caused death from hæmorrhage; the other had perforated the left kidney, the spleen and stomach; around the latter there was very little bleeding, whereas around the former was much blood-clot. The medical evidence clearly proved that the heart wound was caused first, and the other only when circulation was rapidly failing; the interval between them was, however, to be measured only by seconds. Witnesses of fact corroborated the medical evidence. It was a clear case of murder, and the accused was hanged.

If several wounds have been inflicted through the clothing, an examination of this may sometimes suffice to show which was first received.

A man, in struggling with an assailant, received three stabs with a knife—two on the left elbow, and the third in the back. The latter was at about the level of the eighth rib, was vertical to the chest, and had clean edges. The lower margin was obtuse, the upper acute; hence it was evidence that the cutting edge of the weapon had been directed upwards. It had traversed the left lung and the heart, and had caused immediate death. It was obvious, on examination, that this mortal wound had been first received, and the stabs at the elbow inflicted subsequently.

These two stabs, which were slight, had divided the cloth coat and shirt, and had only grazed the skin, so that no blood had been effused. But the edges of the cuts in the cloth coat and shirt were stained with blood; hence it was evident that they must have been produced by a weapon already rendered bloody by a previous wound. The fact was of some importance in the case, and the correctness of the medical opinion was confirmed by the evidence given at the trial.

Evidence from Foreign Bodies in the Wound. Foreign substances are sometimes discovered in contused or lacerated wounds, and these may throw an important light on the circumstances in which a crime has been perpetrated.

In *R.* v. *Hazell* the body of the deceased was found in a well. When examined, there were on the head several wounds sufficient to account for death. There was much blood on the clothes and face, and in the blood were sticking a quantity of hay-seeds, which led the medical witnesses to conclude that the wound must have been inflicted in a stable, or in some place where there was hay. On examining a neighbouring stable the spot where the murder was committed was rendered evident by the discovery of marks of blood.

There may be found in the wound a portion of the weapon itself. The preservation of this is necessary, as it may serve to connect an accused person with the crime.

In *R.* v. *De Salvi* the deceased died from a stab inflicted on him by the prisoner. Two inches of the pointed portion of the blade of a knife were found imbedded in one of the vertebræ. The spinal cord had been divided, and paralysis, ending fatally, was a result of the wound. The identity of the weapon was not only established, but the force by which it had been used by the prisoner was thus clearly indicated.

In *R.* v. *Moore*, where the prisoner was charged with murdering his wife, the woman's throat had been cut through to the spinal column. The surgeon, in making a minute examination of the deceased's neck, found small particles of steel, which had formed part of the edge of a cutting instrument, broken off and embedded in the muscles and bones. These were examined microscopically, and their nature verified. They were covered with blood. In a box in the prisoner's room two razors were found. The blade of one of these, stained with blood from end to end, had been partly wiped. The edge of this razor presented several notches, corresponding to the portions of steel found on the vertebra of deceased. The handle of the razor was also partly unrivetted, showing that it had been used with very great force. Suicide was not only thus disproved, but the act of murder was fixed upon the accused.

8. Evidence from the Surroundings

In pursuing the examination of the question respecting the homicidal or suicidal origin of wounds, the attention of the reader may be called to the weight of the evidence derived from the circumstances in which the body of a person who has died from wounds is discovered. There are few members of the medical profession who, when summoned to aid justice in the detection of crime, would not seek to ascertain facts in support of the medical evidence required of them. A practitioner would certainly be wrong to base his professional opinion exclusively on the facts so ascertained, but it is scarcely possible for him to avoid drawing an inference from them as they fall under his observation. His evidence may of itself be weak and insufficient to support the charge against the accused; in such a case if any suspicious circumstances have come to his knowledge, he may be often unconsciously induced to attach greater importance to the medical facts than he is justified in doing. But if a proper degree of caution is exercised in drawing inferences, and the circumstances are not allowed to create a prejudice in his mind against the accused, a practitioner is bound to observe and to record them; for, being usually the first person called to the deceased, many facts capable of throwing an important light on the case might remain unnoticed or unknown but for his attention to them. The position of a dead body, the distance from it at which a knife or lethal weapon is found, the direction of the instrument, whether situated to the right or left of the deceased, the marks of blood or wounds about the person, or of blood on the clothes or on the furniture of the room, are facts which may assist materially in arriving at the real nature of a case, and in giving force to a medical opinion. Many of these circumstances can fall under the notice of the one who is first called to the deceased; and, indeed, if observed by another, no advantage could be taken of them except from the interpretation of a medical man.

Among the questions which present themselves on these occasions are the following: Is the position of a wounded body that which a suicide could have assumed? Is the distance of a weapon from the body such as to render it improbable that it could have been placed there by the deceased? In answering either of these questions, it is necessary to take into consideration the extent of the wound, and the time at which it probably proved fatal. Again, it may be inquired, Has the deceased bled in more places than one? Are the streams of blood all connected? Are there any marks of blood on his person or clothes, which he could not well have produced himself? Are there any projecting nails or other articles which might account for wounds on the body as the result of accident? These are questions, the answers to which may materially affect the case; hence a practitioner, in noticing and recording the circumstances involved in them, ought to exercise due caution. "The consideration of the nature of circumstantial evidence," observes Starkie, "and of the principles on which it is founded, merits the most profound attention. It is essential to the well-being at least, if not to the very existence of civil society, that it should be understood that the secrecy with which crimes are committed will not ensure impunity to the offender. At the same time it is to be emphatically remarked that in no case and upon no principle can the policy of preventing crime and protecting society warrant any inference which is not founded on the most full and certain conviction of its truth, independently of the nature of the offence and of all extrinsic considerations whatever. Circumstantial evidence is allowed to prevail to the conviction of an offender, not because it is necessary and politic that it should be resorted to, but because it is in its own nature capable of producing the highest moral degree of certainty in its application. Fortunately for the interests of society, crimes, especially those of great enormity and violence, can rarely be committed without affording vestiges by which the offender may be traced and ascertained. The very measures which he adopts for his security not infrequently turn out to be the most cogent arguments of guilt. On the other hand, it is to be recollected that this is a species of evidence which requires the utmost degree of caution and vigilance in its application."

The rule respecting the admissibility of this kind of evidence applies to facts of a *medical*, as well as those which are of a physical or moral kind. Medical facts, when properly observed and interpreted, are often of the highest importance. In order to convict an accused person on circumstantial evidence, the facts proved in the case should be consistent with his guilt, and be utterly inconsistent with his innocence; or, in the language of a judge, a certain number of material facts should be incontestably proved in the case which are quite inconsistent with the innocence of the accused. These facts should be such as to render it impossible in the minds of the jury that anyone but the accused could have committed the crime. Alderson, B., in charging a jury to this effect, made an observation in reference to circumstantial evidence which should be remembered by medical witnesses. He pointed out to them the "proneness of the human mind to distort the facts in order to establish such a proposition" (the guilt of the accused), "forgetting that a *single circumstance* which is inconsistent with such a conclusion is of more importance than all the rest, inasmuch as it at once destroys the hypothesis of guilt."

There are many cases on record in which an observation of slight and unexpected circumstances by medical men has led to the detection of offenders.

In the life of Sir Astley Cooper, it is mentioned that when called to see Mr. Blight of Deptford, who had been mortally wounded by a pistol-shot in the year 1806, he inferred from an examination of the localities that the shot must have been fired by a *left-handed* man. The only left-handed man near the premises at the time was one Patch, who was not in the least suspected, a particular friend of the deceased. This man was, however, subsequently tried and convicted of the crime, and he made a full confession of his guilt.

Position of the Body and Clothes. The body may be found in a position which the deceased could not have assumed on the supposition that the wound or injury was accidental or suicidal. The position of a dead wounded body is often only compatible with homicidal interference, either at the time of death or afterwards. In order to determine the probable time of death, it should always be noticed whether there is any warmth about the body—whether it is rigid or in a state of decomposition, and to what degree this may have advanced (*vide* " How Long Dead ?").

The position of the body when a wound was inflicted is a frequent question on inquests and criminal trials. In the case of Lord William Russell, (*R.* v. *Courvoisier*[1]) the throat had evidently been cut while the deceased was lying in bed ; the blood was effused on each side of the neck only. There was also found a wound on the thumb of the right hand of the deceased, probably inflicted at the time when the hand was put up to defend the throat.

In a case of fratricide, the deceased had received a severe wound at the lower part of the neck, and another in the front of the chest, which had led to his death. As the blood had run down the front of the person from both of the wounds, and one of them was so deep that the deceased, unless supported, would probably have immediately fallen, it was inferred that two persons had been engaged in the murder, and that one held the deceased by the arms while the other struck him in front. This suspicion was corroborated by there being no marks of wounds upon the hands. The opinion thus expressed was singularly confirmed by the evidence adduced at the trial of the murderer.

If the deceased has been wounded with his clothes on, we should notice whether any part of his clothing has or has not been cut or injured over the situation of the wound, whether the cut portions of clothes are bloody, and whether the blood has been effused or applied on the *inside* or *outside*. When, together with a wound in the throat, we find the tie and the shirt cut through, this, all other circumstances being equal, is strongly presumptive of homicide. A person intending suicide, unless suffering from confirmed insanity, would not allow any mechanical obstacles of this kind to remain as an obstruction to the use of the weapon. In one case of homicidal wound of the throat, inflicted in the recumbent posture, the tie of the deceased had been lifted up, and afterwards allowed to drop over the wound, in order to conceal it. The importance of examining the clothing and comparing it with the marks of violence on the body has already been pointed out.

Marks of Blood or other Substances on the Deceased and in the Room. All marks or stains of blood or dirt on a dead body require special observation. The impression of a hand, or of some of the fingers, may be found on the skin in a situation where it would have been improbable or impossible for the deceased to have produced it, even supposing that one or both of his hands were covered with blood.

In *R.* v. *Gardner*, already referred to as illustrating other important medico-legal points (*see* p. 327), Sequeira found an impression made by sooty fingers on the inside of the left wrist and a similar sooty impression on the left elbow, as if it had been forcibly grasped. On the inside of the right thigh there was the impression of the palm of a bloody hand of full size, pointing downwards. He noticed these marks before the prisoner, who was a chimney-sweep, had entered the room ; and he also observed that there was no soot on the hands of the deceased, and no blood sufficient to produce such an impression of blood as that existing on the right thigh. The impression was also larger than the hand of the deceased.

In one case of murder there was found the bloody impression of a left hand upon the back of the *left hand* of the deceased.

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[1] C.C.C., 1840 (unreported.)

In all cases it should be noticed whether the *inside* or *outside* if the hand or whether one or both hands are marked with blood and the size or position of the marks should be described. Stains of blood on the clothes of a wounded person or dead body may often furnish important circumstantial evidence. If there are several stabs or cuts on the body involving the clothes, it should be observed whether the edges of one or more of them are stained with blood, as if from the wiping of a weapon, and whether the stain is on the outside or inside of the article of clothing. In simulated personal injuries, the stain of blood may be through inadvertence applied to the outside of the clothes—a fact which might, in some instances, lead to the detection of the imposture.

In judging from marks of blood in the *room*, we must take care that we are not unconsciously misled by the accidental dispersion of this liquid by persons going in and out or touching the body. The following case, which occurred in France, will show the necessity for extreme caution.

A young man was found dead in his bedroom with three wounds on the front of his neck. The physician who was first called to see the deceased had unknowingly stamped in the blood with which the floor was covered, and had then walked into an adjoining room, passing and repassing several times ; he had thus left a number of bloody footprints on the floor. No notice was taken of this at the time ; but on the following day, when the examination was resumed, the circumstance of the footprint was particularly attended to, and excited a suspicion that the young man had been murdered. The suspected person was arrested, and would have undergone a trial on the charge of murder had not Marc been called in to examine all the particulars of the case. Similar circumstances occurred in the case of Eliza Grimwood, who was murdered at Lambeth in 1838.

In the case of Mrs. McPherson, Macleod observed footprints in blood in the bedroom of the deceased, who was found dead from wounds obviously homicidal. There were three imprints of a naked foot, one of them particularly well marked. There was the impression of a small, well-formed foot at rest. Before any suspicion was attached to anyone the medical witness expressed an opinion that they were made by a woman's foot with a high instep. At the time of this act of murder there were only three persons in the house : the prisoner, the deceased, and a man aged eighty-seven, James Fleming. Macleod observed that there was no blood on the feet of the deceased : further, he made a careful outline of her left foot, and found that it did not in any way correspond to the footprints on the floor of the room. In his opinion the left foot of the deceased could not have produced these marks. He compared the foot of James Fleming with the footprints, and they were obviously quite different ; he had a flat foot, in contradistinction to a high sole, by which the marks had been produced. He was quite satisfied that the old man's foot could not have caused them. He also compared the feet of the prisoner with these marks, especially the left foot, and the marks, in his judgment, might have been produced by her foot. The accused made no objection to tread with her left foot in a thin layer of bullock's blood and then step on a plank of wood. When all the conditions of the floor were imitated, two impressions were obtained which corresponded with a marvellous degree of accuracy with the marks taken from the house. In the minutest detail of measurement and outline they tallied with the original.[1]

Marks of Blood on Furniture. It is proper to notice all marks of blood in the room, and to observe where the greatest quantity of blood has been effused ; this is generally found on the spot where the deceased has died. The deceased may have bled in more places than one ; if so, it should be noticed whether there is any communication in blood between these different places. Blood on distant clothes or furniture will show whether the deceased has moved or has been moved about, and whether he has struggled much after receiving the wound. Acts of locomotion by a wounded person who has died from loss of blood, or by a criminal whose hands and feet may be bloody, are generally indicated by tracks or marks of blood. The hands and feet of the victim should always be examined to see if they are blood-stained. If they are not, the presence of bloody footprints or fingerprints indicates the presence of another person. The observation of these marks is of medical importance, if made at the time that a dead body is found. They may be so situated as to show that the body has been moved or been interfered with after death and thus throw a light upon the question whether death was homicidal or suicidal.

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[1] Trial of Mrs. McLachlan : "Notable Scottish Trials."

In *R.* v. *Hatto* a mark of blood, as from the smear of a hand, was traced along the passage of the house in which the body of the deceased was found. The mark was continued over the doorpost into a back room, which was found locked and bolted on the inside. The crime was thus fixed upon the prisoner, for no one breaking into the house in front could have had access to this room. The evidence thus brought against him was the result of his feeling his way with a bloody hand in the darkness after the murder.

In *R.* v. *Muller* the outside handle of the carriage door, in which the fatal assault was made, was marked with blood, whereas there was no blood upon the hands of the deceased, which were examined soon after the assault. This was adverse to the theory that the deceased had opened the door and had fallen out, whereas it proved that a hand stained with fresh blood had been in contact with it.

R. v. Spicer affords an illustration of the importance in cases where it is suggested that death has been caused by accident, not only of examning minutely the wounds, but also the location of the dead body when found :

The prisoner was charged with the murder of his wife. The deceased was found dead at the foot of a stair, as if she had accidentally fallen backwards. The parietal bone was fractured, and the fracture had extended to the base of the skull. The brain was lacerated, and there was great effusion of blood. The second vertebra of the neck was fractured, and the spinal marrow torn through. These injuries were quite sufficient to account for death, and had they existed alone there might have been no reason to charge the husband with the murder. But there was a recent wound on each side of the temple, partly lacerated and partly bruised, and a branch of the right temporal artery had been divided, this injury having been inflicted apparently with a pointed blunt instrument. There were marks of blood on the wall at the *top* of the staircase, which had evidently been produced by the spurting of a living artery. It was therefore obvious that the injuries to the two temples *laterally* could not have been accidentally produced during the fall, for there was no projecting body against which she could have struck in her descent to produce them ; and when the force of the fall had been spent on the head, her body could not have rolled over so as to produce punctured and lacerated wounds on both temples. All the facts tended to show that a murderous assault had been made upon her at the top of the stair, and that she had afterwards fallen or had been pitched headlong backwards.

Inference from the Quantity of Blood. When the blood vessels of the neck have been divided to the vertebral column, and the amount of blood on the spot where the blood is found is small, there is reason to infer that there has been interference with the body after the wound was inflicted. From such a wound there should be evidence of spurting and copious loss of blood, but the quantity of blood on the spot where the body of a child was found was so small (about two tablespoonfuls) compared with the severe wounds on the neck that the medical man properly drew the conclusion either that the wounds had been inflicted elsewhere or that they had been produced on the body after active circulation had ceased. There was reason to believe that the child had been first suffocated, and the severe wound dividing the blood vessels of the neck inflicted soon afterwards, although this is not in accordance with the prisoner's confession.

Observations made in carrying out sentences of execution by decapitation show that on a division of the great blood vessels of the neck during active life the flow of blood is copious and instantaneous. In the case of Mrs. Gardner, the body was straight on the floor, as if laid out, and although the carotid artery had escaped division, there was a pool of blood on the floor on each side of the throat, and this had run down the back.

9. Evidence Derivable from the Weapon

There are several matters in connection with a weapon which may afford strong evidence.

The Position of the Weapon. Where a person has died from an accidental or self-inflicted wound, likely to cause death either immediately or within a few minutes, the weapon is usually found either close to the body or within a short distance of it. If found near, we must notice on which side of the body it is lying, and if at a short distance, consider whether it might have fallen to the spot, or have been thrown or placed there by the deceased. If there has been any interference with the body, evidence as to the relative positions of it and the weapon will be inadmissible. In one case, a woman had evidently died from a severe wound in the throat, homicidally inflicted. A razor was found in a very unusual position, namely, under the left shoulder, the body having been carelessly turned over before it was seen by the surgeon first called in.

It is compatible with suicide to find a weapon at some distance, or even concealed, but it is much more frequently found either grasped in the hand or lying by the side of the deceased. In one instance, the deceased was discovered in bed with his throat cut, and the razor lying *closed* or shut by his side. In another case, the bloody closed razor was found in the deceased's pocket. In a wound involving the great blood vessels of the neck, it is improbable that there should be any power to close or shut the razor with which the wound was inflicted ; and there are fair grounds to suspect interference when a razor is thus found closed in the hand. Exceptional cases do occur, however. In a clear case of suicide the deceased had cut both internal jugular veins and both superior thyroid arteries, the cut having passed to the fourth intervertebral disc, which it injured. He then put the razor in its case and replaced the case in his kit-bag.[1]

There is one circumstance in relation to the position of a weapon which is strongly confirmative of *suicide*. If the instrument is firmly grasped in the hand of the deceased, no better circumstantial evidence of suicide can be offered. It does not seem possible that any murderer could imitate this condition, since the relaxed hand of a dead person cannot be made to grasp or retain a weapon, like the hand which has firmly held it by powerful muscular contraction at the last moment of life (*vide* "Instantaneous Cadaveric Rigidity."

In regard to the finding of the weapon at a distance from the body, all the circumstances of the case should be taken into consideration before any opinion is expressed. If the weapon cannot be discovered, or if it is found concealed in a distant place, this is presumptive of homicide, provided the wound is of such a nature as to prove speedily fatal.

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[1] Shore, T. H. G., *Lancet* 2 : 180, 1920.

Something may be learned from the actual **nature of the weapon** itself taken in conjunction with the circumstantial evidence as to why the particular weapon was used. For instance, an Italian committed suicide by plunging a pair of scissors into his neck. He was a bad-tempered man, and had been greatly upset by the desertion of his wife. The wife, accompanied by relatives, went back to get her wearing apparel, and the husband, who had expressed his intention of ending his life, put his threat into execution while they were in the house.

Nature of its Edge. It should be noticed whether the weapon is sharp or blunt, straight or bent, and whether the edge is or is not notched. These circumstances may throw a light on the question of suicide or murder.

In *R. v. Gill* the prisoner was charged with the murder of his wife. The woman was found dead with a wound in her throat dividing the larynx as well as the thyroid arteries and gullet at the thyroid cartilage. It penetrated to the front of the spine, which was hacked and notched apparently with some violence. Several pieces of bone were detached. The right hand of the deceased was turned back, and a blunt knife was lying in it loosely, and not grasped. The cut through the skin and muscles of the throat was clean, and had evidently been made by a sharp instrument. On the left side the cut had two extremities presenting an appearance as if the weapon had been twice used in cutting. The knife found in the hand of the deceased was not only blunt, but turned at the point, and it had no handle. There was a mark of a bloody finger on the dress over the left shoulder of deceased.

From these facts Porter and Geoghegan drew the conclusion that the deceased had not inflicted this wound on herself. Among other circumstances, the hacking of the spinal column and the evidence of two separate cuts were adverse to the theory of suicide. Further, the wound had not been made with the knife found in the hand. If this weapon had been used for the purpose of suicide, it would either have been grasped in, or have altogether fallen out of, the hand. The deceased had not produced the bloody mark of a finger found upon her dress. These conclusions were fairly justified by the facts. A blunt knife had been substituted for a sharp razor ; the placing of the knife in the hand had failed to give the appearance presented in suicide ; and the nature of the wound was inconsistent with the idea of self-infliction. The prisoner was, nevertheless acquitted.

Blood on Weapons. For the methods of obtaining and testing blood, see p. 396.

The weapon with which a wound has been inflicted is not necessarily covered with blood. The popular view is that, if much blood is found about a dead body, the weapon should be bloody. In reference to heavy blunt instruments applied with force to the head, severe contusions and fractures may be produced without immediate effusion of blood. Unless the bludgeon is used in a subsequent struggle, or handled by a bloody hand, no blood whatever may be found on the end which produced the injuries. In stab wounds, the knife may not be bloodstained, or there may only a light film, which on drying gives to the surface a yellowish colour. The explanation of these facts appears to be that in a rapid blow or plunge the vessels are compressed, so that bleeding takes place only after the sudden withdrawal, when the pressure is removed. Even if blood should be effused, the weapon, in being withdrawn, is sometimes cleanly wiped against the edges of the wound owing to the elasticity of the skin, or it may be wiped by the clothes as it is withdrawn. Thus the first stab through the clothes may not present any appearance of blood on the outside, but in a second stab with the same weapon the outside of the clothes should present a bloody mark, unless the weapon had previously been wiped. The blood may have been removed by washing from the blade of a knife or dagger. The handle and inner portions should therefore be closely examined.

In a case of alleged murder no blood was found on the blade of a knife or in the notch for opening it; but on removing the buckthorn handle a coagulum of blood was found between this and the plate of iron to which it was riveted.

When a weapon is bloody, particular attention should be given to the manner in which the blood is spread over it. In cases of imputed wounds, or in the attempted concealment of murder, it is not unusual for a criminal to besmear with blood a knife or other weapon which has probably not been used, and to place it near the body.

A young man alleged that he had received a cut on the forehead by a blow from a cutlass. It was observed by the medical witness that the weapon was smeared with blood on both surfaces, but the layers were thicker towards the handle than at the point. The wound on the forehead was a clean incision; and a cap which the complainant wore, had been cut through. It was obvious, therefore, that the blood on the weapon could not have proceeded from this cut.

In *R. v. Doidge* the weapon, a large cleaver, had been wiped on the smock of the deceased, but although the blood had been thus in great part removed from the surface of the blade, it had been wiped into the recesses of the letters of the maker's name, which were found to contain coagulated blood.

The blood on a weapon may be wet or dry, in a partly coagulated state, or spread out as a mere film. If coagulated, this would render it probable that it had issued from the body of a living person or animal, or from a body recently dead. Blood dried in small spots on the blade of a knife may sometimes present a similar appearance, and thus lead to a mistake in evidence.

In a case where a man was convicted of the murder of a prostitute in New York, the evidence of Austin Flint of the finding of blood and matter derived from the small intestines beneath the finger-nails and on the clothes, etc., of the murderer, was highly important. The finding of tyrosine, and bilirubin (one of the pigments of bile), besides matters which might have come from the large intestine, was held to be conclusive that the presence of these matters was not due to the filthy habits of the prisoner.

The Use of Several Weapons. In general, suicides, when foiled in a first attempt, continue to use the same weapon; but sometimes, after having made a severe incision in the throat, they will shoot themselves, or adopt some other method of self-destruction. These cases can only appear complicated to those who are unacquainted with the facts relative to self-murder. Neither the presence of several wounds by the same kind of weapon, nor of different wounds by different weapons, can be considered of itself to furnish any proof of the act having been homicidal. A case has been reported in which an insane person in committing suicide inflicted *thirty* wounds upon his head, and another in which 440 separate wounds were inflicted on the body. In a case of murder, when many wounds are found on a dead body, it may happen that the situation or direction of some will be incompatible with suicide. Thus a stab or cut may be close to a contusion or contused wound, and although a fall or other accident might account for the latter, the former would indicate violence separately inflicted.

A case is quoted[1] in which a person who killed himself by hanging was found to have inflicted injuries upon himself by a revolver, had tried to cut his throat, and had attempted to sever the arteries at his wrist before hanging himself.

Hair and other Substances on Weapons. In some instances no blood may exist on a weapon, but a few hairs or fibres may be found adhering to it. The main question may be in such a case whether the fibres are of cotton, linen, silk, wool, or other fabric, and whether the hair is that of a human being or of an animal. In one of our cases the driver of a motor car was arrested for causing the death of a child. The child was found dead on the road, and from the marks of the tyres of a motor car the police traced and arrested a certain driver. The car was examined, and some hair was discovered on the front mudguard. This was examined and found to be cow's hair. In numbers of cases we have been able to identify fibres of different kinds found on vehicles of accused persons as exactly similar to those taken from the clothing of a person killed by a collision. Hairs from the deceased persons taken from cars bumpers, etc., have been identified in many cases. For the means of identifying such fibres *vide* " Identification of Hair."

In *R. v. Harrington*,[2] a razor was produced in evidence, with which it was alleged the throat of the deceased had been cut. The edge was examined, and from a coagulum of blood some small fibres were separated, which, under the microscope, turned out to be cotton fibres. It was proved that the assassin, in cutting the throat of the deceased while lying asleep, had cut through one of the strings of her cotton nightcap. This was a strong circumstance to show that the razor produced was the weapon with which the fatal wound had been inflicted.

In *R. v. Steed*,[3] Pavy and Taylor examined the boots of the prisoner who was charged with the murder. The marks of violence about the head showed that the assailant had trampled on the deceased after he was on the ground, producing severe wounds which led to his death. Some hairs were found firmly wedged beneath the large hobnails of the boots, and in certain dark stains of coagulated blood on the leather there were some red woollen fibres. The hair was compared with a portion cut from the head of the deceased, and corresponded in colour and size. On inquiry it was found that at the time of his death the deceased wore around his neck a red woollen comforter, of which the wool corresponded in colour and appearance with that taken from the prisoner's boots.

10. Evidence Derivable from an Examination of the Assailant

Marks of Blood or Wounds on the Assailant. It is a common, but erroneous, idea that no person can commit a murder in which blood is effused without having his person and clothes more or less covered with blood. On several occasions articles of clothing have been examined which have been worn by persons subsequently convicted of murder by wounding, and either no blood has been found on any part of the dress or only small spots wholly out of proportion to the quantity of blood which must have flowed from the deceased.

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[1] " Forensic Medicine," Sydney Smith, 8th Edition, p. 127, (1943).

[2] Essex Lent Assizes, (1852).

[3] Maidstone Assizes, (1863).

In *R. v. Gardner*, in which there had been a large effusion of blood from a severe wound in the throat, no bloodstains were found on the clothing of the man who was convicted of the murder.

The throat of a person while standing, sitting or kneeling may be cut by a murderer from behind, and thus simulate suicide. In these circumstances the clothes of the assassin would probably not be stained with blood. The flowing or spurting of blood upon his clothes would depend upon his position in relation to the victim at the time of inflicting the wound, and this must always be a matter of pure speculation. In entire violation of this simple principle, the fact of a prisoner's clothes not being marked with blood has been on more than one occasion urged as a proof of his innocence.

In *R. v. Dalmas* the counsel for the prisoner contended that no person could cut the throat of another without having his clothes covered with blood, and that as it was not proved that there was any blood on the clothes, the prisoner could not have been guilty of the crime. The throat of the woman was cut while she was walking across Battersea Bridge, the prisoner having inflicted the wound from behind. In the case of Lord W. Russell, the act of murder was committed by Courvoisier while in a state of nudity. In *R. v. Muller* this line of defence was carried to a still greater length. Although the clothes of the prisoner were not produced, and the evidence showed that he had had time to change them, the counsel for the defence said, " Blood spurted out from the deceased, and there is no doubt his assailant, whoever he was, must have been covered with blood, or have been considerably stained with it." The wounds were of a contused nature, from which much blood was not likely to have flowed at the time of their infliction.

The clothes worn by the assailant need not, therefore, from this state of facts, have been " covered with blood," nor " considerably stained." No artery was cut through, and there was no evidence of spurting. Setting aside these erroneous assumptions, the evidence tended to show that had blood fallen upon his clothes, the prisoner had ample time to dispose of them, and thus prevent a chemical examination of them. In *R. v. Smith* the fact that too great reliance was placed upon the absence of bloodstains on the clothing of the accused, as adverse to the theory of guilt, appears to have led to a failure of justice.

The deceased was found with his throat cut. The wounds in the throat were of such a nature that they could not have been inflicted by the deceased himself, and might have been made by another person from behind. The accused was traced to the spot, and a cap belonging to him, and saturated with blood, was found under the dying man. In his charge to the jury the judge is reported to have said : " There were very slight, if any, traces of blood upon his clothes, and it appeared to him impossible that the person who committed this deed should not have been deluged with blood from the wound," etc. The medical evidence was to the effect that there were some stains of blood on the clothes which were damp. They had been washed. The jury acquitted the prisoner.

In the Eltham murder case (*R. v. Pook*), a young woman was found dead with severe injury about her head inflicted by a plasterer's hammer. One of the wounds divided the temporal artery. The prisoner's clothes were examined by a medical man who found upon them numerous small spots of blood, apparently recent. The judge, in charging the jury, said : " Was it likely that the person who inflicted all that violence, dividing arteries as he did in some places, could have done it without considerable marks of blood being afterwards found upon his clothes ? "

This question, if addressed to a medical witness who had had experience in examining such cases, would have been answered in a very different manner from that suggested. The spots were just such as might have arisen from a blunt weapon inflicting these wounds. The effect of spurting on the clothes by the divided temporal artery would have depended on the position of the assailant at the time. By a bruising instrument of this kind " considerable marks of blood " were not likely to have been produced. Even when there has been a good deal of splashing, shown by the presence of spots of blood around the body of the deceased, on the walls, furniture, etc., it is quite common to find that the clothing of the murderer shows comparatively few stains and this fact must be kept constantly in mind.

There is no doubt that policemen are often misled in searching for criminals by relying upon blood on clothing as a necessary accompaniment of an act of murder. The same idea leads them to confuse stains of red paint, iron rust, and fruit stains, on the clothes of an accused person, with marks of blood.

Per contra, the presence of spots of blood on articles of clothing, knives, etc., taken from the persons of those who are accused of murder, may be quite consistent with innocence. Small spots or stains have often an undue importance attached to them. Minute spots of blood on the shirt of a man tried for murder by wounding have been accepted as evidence of guilt, until it was explained that they were probably derived from flea-bites, and that some were on one side and some on the other, showing that the shirt had been worn on the two sides. The coarse clothing worn by manual workers may acquire blood-spots from a variety of accidental circumstances which the wearer may not always be able to explain. When an attempt has been made to wash out the stains, or the accused admits that they are there, and shows great anxiety to give some explanation of their presence, as that he has assisted in killing a pig, rabbits, or rats, or that he had been carrying game, there may be some ground for suspicion. Due allowance should always be made for the accidental presence of blood.

Whether blood is or is not found on the clothing of a person charged with murder, any **wounds or marks of violence upon him** should be specially examined. These may have been produced in a struggle with the deceased, and the accused may not be able to give any consistent account of the time or mode of their production. A case has been related (p. 293) in which the identity of an assailant was in some manner established by the form of an ecchymosis on his face. So a wound may be found on the accused which he may pretend to account for by some accident, or in order to evade suspicion. His statement may, however, be wholly irreconcilable with the appearances of the injury. The kind of weapon used, and the period at which the wound was inflicted, may sometimes be inferred from a simple examination and prove that the prisoner's story is false. A case of this kind was tried, in which an assailant was identified by the peculiarity of a wound on the knee.

He had broken into a house at night with some others, and discharged his gun at the prosecutrix, while he was in the act of kneeling or stooping. The gun burst, and the recoil of the breech produced a mixed laceration and contused wound on the knee of the assailant. When the prisoner was called upon to account for this wound, he referred it to an accidental blow from a mandril some time before. The appearance of the injury was, however, inconsistent both with the time of its alleged accidental infliction and with the instrument said to have produced it; while, on the other hand, it was proved to correspond with such an injury as the broken breech of the gun would have produced at the date of the burglary.

This led to the identification of the prisoner, and to his subsequent conviction.

Two men were charged with having assaulted, with intent to rob, a surgeon who, while he was walking along a lonely road in the country, overtook three men who were strangers to him. One knocked him down by a severe blow on the face and held him, while another put his hand upon his mouth to prevent his giving alarm. One of the men contrived to get his finger in the surgeon's mouth and during the struggle the latter bit off the end completely between the nail and the first joint. The piece of finger was given to a constable, and in the course of about eight hours he found one of the men with his hand bandaged. On examining the hand, it was ascertained that the tip of one finger was missing. The man accounted for this by saying that he accidentally cut it off. This statement was found to be false, and he made several other inconsistent statements. On comparing the piece of finger with the injured finger of the man's hand, they were found closely to correspond. The portion of finger was preserved in alcohol for the trial, and upon this clear evidence of identity he and his companions were convicted.

These cases may be taken as types of many others of a similar description.

In connection with the question of accident, suicide, or homicide, the following cases are of interest:—

An inquest was held on the body of a man who had died from a wound in the throat. On the Friday previous to his death he had made a will in favour of his wife, and had requested her to get his money out of the bank. The widow said that she was in the house when her son called her attention to blood upon the deceased's fingers. She thereupon saw a wound in his throat, from which blood was flowing. Having bound up his neck with a cloth, she rushed into a neighbour's house and summoned a doctor. The deceased had inflicted a wound two inches deep while she and the son were in the same room, only a few yards away. She had her back turned at the time, and the deceased had turned away from her. Questioned as to the cashing of a cheque at the time of her husband's death, the widow said that she had signed the deceased's name, but that he had held the pen. The bank manager had refused to cash the cheque. The medical witnesses stated that the knife was held in the deceased's hand very lightly. They were of opinion that the wound could have been self-inflicted. There was no evidence of homicide.

In the following case the **tying of the limbs**, among other items of evidence, clearly proved murder:—

The body of a girl was found near a hedge in a direct line with the back of the street in which she lived. Her hands were tied with a rope. Her feet also were tied together, and the rope went three times around the waist. The throat was deeply cut, and a piece of rag tied around it. The back-door catch of the house where the accused lived with his father showed signs of bloodstains. At one o'clock a police witness saw the accused in the house in his shirt on which were several spots of blood. There was blood on his hands also, and the forefinger of each hand had been freshly cut. The accused said that he cut his finger with his pocket-knife. The kitchen towel was smeared with blood. A bloodstained razor was found in the kitchen. It looked as if it had been newly cleaned. A piece of rag was found which corresponded with the piece which was tied around the girl's neck. The accused's trousers and waistcoat were bloodstained. On a shelf in the coal-house in the accused's house the girl's Tam-o'-Shanter hat was found with blood upon it. The jury returned a verdict of wilful murder.

WOUNDS OF SPECIAL REGIONS

Some of the foregoing general principles must now be considered as they apply to special regions of the body. Cut throat has already been mentioned in many connections; it will not be dealt with further.

We shall consider the following :—

Wounds of the scalp.
,, ,, cranium and brain.
Fractures of the skull.
Wounds of the face.
,, ,, nose.
Injuries to the spine.
Wounds of the chest wall.
,, ,, lungs.
,, ,, heart.
,, ,, veins.
,, ,, diaphragm.
,, ,, abdomen.
,, ,, liver and gall-bladder.
,, ,, spleen.
,, ,, kidneys.
,, ,, stomach.
,, ,, bladder.
,, ,, genitalia.
Fractures.
Dislocations.

Wounds of the Scalp

Wounds of the scalp from mechanical violence must be looked upon as potentially serious, no matter how they are produced, for they are usually septic when inflicted, and if the division of tissues has penetrated below the dense layer of the skin of the scalp, it is difficult to prevent the spread of infection. Many serious scalp wounds however, heal in a remarkable and unexpected manner.

Should suppuration ensue, these wounds are particularly liable to give rise to fatal complications owing to the ease with which the septic organisms can reach the brain, due both to the proximity of the scalp to the brain and also to the very free vascular connection between the structures inside and outside the cranium. The loose manner in which the scalp is attached to the cranium affords further facilities for the spread of inflammation and suppuration.

There is still a further reason for considering scalp wounds dangerous in that it is frequently difficult to be sure whether or to what extent the skull or the brain has been damaged.

Severe or fatal brain injury may be caused without particular damage to the scalp and in this regard the presence of a good crop of hair or a stout hat may be of importance.

Owing to the free manner in which the scalp moves on the closely subjacent bone, injuries produced by blows from blunt instruments frequently bear a close superficial resemblance to cut wounds. It is advisable, therefore, in all scalp wounds to shave the scalp closely and examine the edges and terminations of the wound with special care and to examine closely the deeper parts of the injury to see if the tissues are cut or torn, and to observe the presence of foreign bodies, such as fragments of glass, rock, earth, etc.

Wounds of the Cranium and Brain

Injuries to the head are of importance only with reference to the coincident injury to the brain which probably takes place to a greater or less degree in every injury of any extent to the head.

Such brain injury may be evanescent, leading to but a momentary dizziness or sickness; it may be more intense and lead to concussion or temporary loss of consciousness; or it may cause physical damage, such as contusion or laceration of the brain substance.

Death may occur immediately, but as a general rule, unless the damage is extensive, injury to the brain is rarely the cause of sudden death. The effects are usually instantaneous, and take place at the moment of injury. The violence may, however, lead to intra-cranial hæmorrhage or œdema, in which case the effect may not be observed for some time after the injury. If infection of the meninges or brain occurs, the result may not be noticed for a considerable time after the infliction of the blow.

The Mechanism of Cranial Injuries. When external violence is applied to the skull, it bends to a certain extent under the blow, and the deformation leads to changes in the cranial contents. If the violence is applied over a large area as in falls on a flat surface, there is very considerable deformation of the cranium whether fracture takes place or not, and this leads to a sudden diminution in its volume and consequent general increased pressure in its contents. When the violence is localised, as when the head is struck by a hammer or similar instrument with a small striking surface, the deformation is very localised, and the increase in pressure is but slight. Cushing has shown that when pressure is applied to the brain the effects are almost constant. If the pressure is slowly applied, there is first a congestion of the brain which causes irritative symptoms. As the pressure increases there comes a point when the brain suddenly blanches, and when this is seen paralysis at once occurs. We may, therefore, associate congestion of the brain with irritative symptoms, and anæmia of the brain with paralysis.

In all head injuries there is likely to be a combination of these conditions, local or general pressure leading directly to congestion or anæmia. Hæmorrhage causes local pressure with congestion in other parts of the brain, and is followed by general pressure.

Œdema is a further agent in causing brain symptoms in all kinds of brain injury. There is a considerable difference of opinion amongst specialists as to the importance of generalised œdema of the brain although œdema about the site of an injury is generally admitted. Œdema increases the intra-cranial pressure, and as in any swelling of the brain tends to the production of pressure cones.

We must now devote a certain space to a consideration of the results of violence, concussion, contusion, laceration and hæmorrhage.

Concussion. Concussion may be defined as a state of unconsciousness or impaired consciousness suddenly produced by mechanical force applied to the skull and usually followed by retrograde amnesia. There are many theories to account for this clinical state.[1] [2] [3] There is complete loss of reflexes, almost imperceptible pulse, slow sighing respiration, and cold, clammy skin.

The shock may be sufficient to inhibit completely the vital processes, and death may result. As a general rule, however, the patient revives after a few minutes with symptoms of headache, giddiness, weakness and vomiting.

If death occurs, the *post-mortem* examination may reveal no naked-eye lesions, but as a general rule bruising or laceration of the brain or scattered petechial hæmorrhages will be found.

The recovery may be complete, or there may be an irritative condition, probably the result of small contusions and subsequent œdema of the tissues around them. The commonest sequelæ are headache, which may be of a most persistent and distressing nature, loss of memory, attacks of giddiness, or more grave sequelæ, such as epilepsy and insanity.

Loss of memory for events occurring just before the accident is constant, and is most important from a medico-legal standpoint. Another interesting feature is the possibility of post-traumatic automatism in which co-ordinated purposive acts may be carried out unconsciously; those acts may be completely forgotten by the victim on his recovery.

Contusion and Laceration. When the skull is struck and is depressed by a blow as described above, there may be actual bruising or laceration of the cortex immediately under the site of the blow. This is very common, and is present to a greater or less extent in every severe injury to the skull. In addition to this localised violence, the brain, which is a solid organ, is driven forcibly in the direction of the violence, and other lacerations or bruises may be sustained. These injuries, known as *contre-coup* injuries, are to be found diametrically opposite the site of violence, and tend to be found also about the opposite frontal and temporal poles. They are usually more extensive than the bruising at the site of violence, and may show a definite laceration of the cortex or a bruised area which may extend into the white matter. In addition there may be numerous petechial hæmorrhages in the cerebral tissues, not only in the cortex, but also in the mid-brain and bulb.

Hæmorrhage. It is obvious, of course, that hæmorrhage may occur as a result of laceration of the brain, and there is no doubt that a slow oozing of blood from the lacerated cortex and membranes is responsible for the sudden deaths that occur in patients several days after an injury, and who appear to be making a reasonable recovery.

Apart from this effect, violence applied to the skull may cause free hæmorrhage between the dura mater and the skull (extra-dural hæmorrhage), between the dura and pia arachnoid (subdural hæmorrhage), under the arachnoid (sub arachnoid), or into the brain matter (cerebral hæmorrhage).

In traumatic hæmorrhage there is, as a rule, a distinct interval between the application of the violence and the onset of symptoms. The victim may have lost consciousness by concussion, and may have apparently recovered before the gradual increase of pressure due to the hæmorrhage is able to produce pathological effects. This interval may vary from a few minutes to several hours or even several weeks, as will be discussed under Delayed Hæmorrhage.

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[1] Denny-Brown and Ritchie Russell, Brain 64 : 93, 1941.

[2] Cairns, Hugh, *Proc. Ry. Soc. Med.* 32 : 200, 1942.

[3] Rowbotham, G. F., " Acute Injuries of the Head," 2nd Edition, 1945.

Alcoholic Intoxication v. Head Injury. Alcohol and other intoxicants may cause effects which on occasion may be diagnosed only with difficulty from the symptoms produced by injury. Conditions of shock or concussion are often attributed to drunkenness.

There is nothing in the state of the brain in a dead body which will enable a practitioner to say whether shock or intoxication had existed and had been the cause of the symptoms which ended fatally. The discovery of alcohol in the stomach or in the blood or urine might lead to an assumption that the deceased had been drunk, and marks of violence on the skull or in the brain might prove that he had been injured, but obviously neither of these findings, and assuredly no negative findings, would enable us to solve the problem whether alcohol or injury was the primary and sole cause of death. We must get our answer, if one is possible, before death. The following are the principal directions in which to seek it :

1. **The History of the Case.** This, if obtainable, may decide the matter, but sometimes it may be very incomplete ; for example, the person may have been found insensible by the police or the history may be intentionally misleading.

2. **Smell the Breath.** A smell of drink does not preclude the possibility of injury to the head, and alcohol may have been given to the man with the object of reviving him. If there is no odour of spirit or beer, etc., the presumption is that the symptoms are *not* due to intoxication. It must be remembered also that the breath of a drunk person does not have the clean pungent smell of alcohol, but has a sour, often rather foul, smell. On the other hand, intoxication may be so severe as to give rise to the apprehension of fatal consequences, and concomitant marks of violence might draw attention away from the intoxication.

3. **Note the Pupils.** If they are dilated it may indicate fairly severe shock or alcohol may be suspected ; if contracted, opium poisoning, pontine hæmorrhage or cortical irritation may be suspected ; if unequal, they rouse a strong suspicion of serious head injury ; if inactive to light, the case is serious, whatever be its precise nature, and must be carefully watched. If both pupils react freely to light, it is in favour of regarding the case as probably not serious.

The condition of the pupils in alcoholic coma is now established and finally accepted as it was stated to be by Macewen many years ago. If a person in simple alcoholic coma be allowed to lie still for half an hour or so, his pupils will be found to be contracted ; if external stimulation be applied, such as by pulling the hair, slapping the face, or pulling the patient about, the pupils will dilate ; on leaving him alone they will again contract ; this activity of the pupils to stimuli other than light, with their subsequent return to the *status quo ante*, is practically a pathognomonic sign of alcoholic coma.

4. **Take the Temperature.** If raised, this suggests head injury and possibly a hæmorrhage into the brain (pons) although in the early condition of shock it may be subnormal ; if lowered, this in itself signifies danger, but it does not differentiate the source of it.

5. **Take the Pulse Rate.** A pulse rate of 120 or over generally means that the patient is in a state of shock. Lowering of the pulse rate to 60 or less generally indicates intracranial pressure.

6. **Localised Paralysis** as opposed to general helplessness suggests a local lesion, and therefore strongly suggests serious injury, and not intoxication.

7. **Examine the Urine.** This may differentiate diabetic coma ; it may suggest kidney trouble with uræmia or apoplexy. The presence of albumen or blood will aid in the diagnosis ; alcohol should be tested for.

8. **Note the General Condition of the Skin.** Flushed and sweating, probably drunk ; cold and blue, collapse of a dangerous description ; cold and sweating suggests opium poisoning.

If these points are carefully attended to, an answer to our question can generally be obtained. We leave the matter with the following remarks by Taylor, which are as accurate to-day as when first penned :

> It is to be feared that medical witnesses are not sufficiently careful on these occasions to determine whether there are signs of intoxication about an injured person. Subsequent proceedings may render this a material part of the inquiry. Many a house surgeon of a hospital has been severely blamed for an omission to inquire and satisfy himself whether, in addition to the results of violence, a man who has been brought into hopital has or has not been intoxicated when admitted. The question is of importance : the injuries to the head may have arisen from a fall, and a drunken man may readily meet with such injuries from accident. There can be no excuse for not making a full inquiry into the precise condition of an injured person, and arriving at the best judgment of which the case admits. A state of intoxication renders it difficult to form an accurate opinion in a case of alleged criminal wounding ; but it is always in the power of a witness to satisfy himself by close examination, the use of the stomach-pump, or simply watching the patient, whether he is in a state of drunkenness or whether he is labouring under the effects of disease or violence. In several instances within a recent period persons who have been struck with incipient symptoms of apoplexy in the streets have been seized and locked up as drunk. and have soon afterwards been found dead or dying. Others, who have suffered from violence, have perished from neglect under a similar mistake made by a medical man or by the police. Disease of the brain, as well as injuries to the brain from violence, may give to a man a staggering gait and render him helpless ; they are also commonly accompanied by stupefaction and vomiting. If it should happen that shortly before such an attack the person has taken beer, wine, or spirits, sufficient to give an alcoholic odour either to the breath or the matter vomited, it is at once treated as a case of drunkenness, and the unfortunate person is left to his fate.

Intracranial Haemorrhage—Violence or Disease. The importance of this question, as well as the frequency with which it arises, requires a somewhat lengthy and exhaustive analysis of the answer.

Blood may be found effused in various situations within the skull. The hæmorrhage may be due to violence, to disease, or, in certain circumstances, to violence aided by the presence of disease. By careful examination in the *post-mortem* room it is possible to separate lesions which are due to violence alone from those due to disease alone. In cases in which the final effects of disease may have been precipitated by violence, evidence other than that found at the necropsy may be required before a definite opinion can be expressed.

Special attention must be given to the following points in *the post-mortem examination of the head* :

(1) Cuts, lacerations or bruises of the scalp and face. These are of importance in so far as they throw light on the nature and degree of the violence that has been inflicted.

(2) Condition of the intracranial venous sinuses and large veins as seen on removal of the skull cap. Examine for laceration or *ante-mortem* thrombosis. The superior longitudinal sinus should be examined and opened before cutting through the dura for removal of the brain, the remaining sinuses and the veins of Galen immediately after removal of the brain. Thrombosis in the sinuses occurs not only as the result of inflammation, but in wasting diseases (marasmic thrombosis), especially in children and in chlorosis. It may cause petechial hæmorrhages in the cerebral substance. The following is an example of the importance of examination of the venous sinuses. In this case the question of legal interest was whether the condition was due to disease or poisoning. Had there been a history of a quarrel, violence might well have been suspected.

A girl, aged eighteen, was brought to London Hospital by her "sweetheart." Illness commenced suddenly on the previous day with giddiness, vomiting and headache. In hospital the girl had intermittent attacks of rigidity and progressive coma. Death occurred on the third day after onset. The mother accused the man of having had an abortifacient administered. The man said that he had taken the girl to a chemist to obtain medicine to relieve the headache. At *post-mortem* were found: chlorosis; thrombosis of inferior longitudinal, straight and left lateral sinuses, and of the veins of Galen and veins of corpora striata; small hæmorrhages and softening in basal ganglia; thrombosis of uterine veins; no abnormality in middle ears, uterus, vagina, etc.

(3) The exact site of the hæmorrhage, which may be—

(*a*) Between the bone and dura mater.
(*b*) In the subdural space, that is between the dura mater and arachnoid membrane.
(*c*) In the subarchnoid space.
(*d*) In the pia.
(*e*) In the substance of the brain matter.

(4) Fractures of the skull. The dura must be removed from the base of the skull to prevent fractures in this situation escaping notice; those of the calvarium are easily found.

(5) Condition of middle ears, mastoid cells and frontal sinuses. Open with chisel to see whether acute or chronic inflammation is present.

(6) Condition of the cranial nerves. See whether any nerves are atrophied: abnormally small, and grey on the cut surface. Such atrophy is usually a late manifestation of syphilis of the brain.

(7) Condition of the cerebral arteries. Expose all the larger superficial arteries carefully. Examine for atheroma, syphilitic arteritis obliterans, aneurysms, ruptures, syphilitic or tuberculous erosion. Open lumen of arteries with scissors, to look for thrombosis or emboli.

(8) Note the exact positions of hæmorrhages in the superficial part of the brain substance; then, after incising the brain, note the position of hæmorrhages in the deeper parts.

(9) When hæmorrhage in the cranium is due to disease, this is frequently only a part of a disease present in other organs which must be carefully inspected.

We may now lay down a few **rules of cardinal importance regarding lesions due to violence.**

(1) Fractures of the skull are found at, and radiate (in the direction of the causative force) from, the point of impact upon the cranium, with the following rare exceptions due to the nature of the violence : When a heavy weight, especially an elastic weight, such as the pneumatic tyre of a heavy vehicle, passes over the brow or occiput, the only fractures may be horizontal cracks in the lateral region ; the skull has been compressed from before back, has expanded laterally and has cracked laterally. Cracks, due in the same way to over-expansion, are occasionally present, in addition to other fractures, in falls from a height. The impact of a rifle bullet may cause cracks in the skull, isolated from the fractures at the points of penetration or impact.

(2) Lesions to the soft parts within the skull occur either beneath the point of impact (and any fractures radiating therefrom) or on the opposite side of the cranial cavity.

(3) Unless there is a fracture of the cranium over them it is rare for lesions on the same side as the impact to be anything more than slight hæmorrhage into the subarachnoid space.

(4) The lesions on the opposite side (provided there be no fracture there) are due to **contre-coup.** The cause of these lesions is not definite. They may be due to impact of the brain on the opposite side of the skull, or they may be caused by the motion of the brain when the skull is set in motion by the blow. In such a case the movement of the brain would lag behind the movement of the skull, drag itself away from the opposite side, thus tearing the pia arachnoid.[1] This theory seems quite reasonable, but the lesions of the brain in many cases in which actual tearing of the brain tissue occurs rather suggests a direct injury. If there is no fracture of the skull *contre-coup* lesions are severer than lesions on the side of impact. *Contre-coup* lesions always lie in the line of the force of impact. Thus, if a man falls upon the back of his head, striking the ground with his occiput a little to the right of the middle line, the lesions occur over the left frontal and temporal poles ; the right frontal and temporal poles may also be affected, but to a less degree. If the portion of the occiput struck lies above the central horizontal plane of the brain, then the lower aspects of these poles will be affected ; if below, then the upper aspects will be affected. *The importance of this position of contre-coup lesions cannot be overestimated.* Not only does it enable *contre-coup* lesions to be recognised with certainty and thus disease to be excluded as a cause of them, but it is frequently of use in other ways. Thus if a man has *contre-coup* lesions in the sites given above, no fracture of the skull, and a bruise upon the forehead, then these intracranial lesions are certainly due to impact on the occiput ; they are not the direct result of a blow on the forehead, though the bruise on the forehead may be evidence of a blow which caused the man to fall upon his occiput.

This statement is obviously of the highest degree of importance in cases of quarrels amongst drunken men when the evidence regarding blows given or received is so disputable.

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[1] Denny-Brown and Ritchie Russell, Brain, 64 : 93, 1941.

Contre-coup may cause groups of pinhead hæmorrhages, larger areas of hæmorrhages, ruptures of the pia arachnoid membranes or actual disruption of the brain substance.

Such are the cardinal rules in respect of lesions due to violence. A list may now be given of the causes of hæmorrhage in the meninges and brain with points for the differential diagnosis between trauma and disease. The question of trauma *plus* disease will receive separate discussion.

Causes of Hæmorrhage into the Meninges. (1) *Hæmorrhage between the bone and dura mater.* Unless purulent inflammation is present, such hæmorrhage is due to fracture of the skull, or rupture of a middle meningeal artery in the course of a fracture, or to tearing of the venous sinuses similarly associated with fracture of the bone, except in infants, in whom it can be caused without fracture, by movement of the cranial bones over one another ; this is frequent in difficult labour.

(2) *Hæmorrhage into the subdural space.* Subdural hæmorrhage (Pachymeningitis hæmorrhagica interna) is relatively common after any kind of violence to the head. Such hæmorrhage may be caused by laceration of one of the venous sinuses when it is likely to cause rapid symptoms and death, or by laceration of one of the small veins between the dura and arachnoid. This latter type of bleeding is slow and as a rule the pressure produced causes the hæmorrhage to cease. The violence applied may have been relatively trivial and the hæmatoma may cause few symptoms. The layer of blood clot is then encapsulated by a fibroblastic membrane—a process which begins within a few hours, and which is completed within a few weeks. Granulation tissue is found on the dural side and spontaneous bleeding may occur from time to time from the thin walled capillaries of this tissue leading to progressive enlargement. It may be seen as a brown mass more than an inch thick. This condition is known as pachymeningitis hæmorrhagica interna and was formerly believed to be due to an inflammatory process, but it is now generally conceded to be caused by trauma.[1] It is more liable to be found in cases of arteriosclerosis, alcoholics, and in the aged.

Gardner[2] suggests that the increase in size of these hæmatomata is due to osmosis of cerebro-spinal fluid into the tumour caused by the increase in molecular concentration due to the disintegration of the clot. The contents of the hæmatoma support this theory for they may be partly or wholly fluid and the fluid may be black and viscous or brown and watery.

Baker[3] has shown that occasionally a subdural hæmatoma may be caused by local inflammation. Having excluded inflammation, escape of blood from the subarachnoid space, and pachymeningitis hæmorrhagica, hæmorrhage in the subdural space is due to fracture of the skull, rupture of the middle meningeal artery, tearing of venous sinuses, or tearing of cerebral veins as they enter these sinuses. These lesions as noted above, all require fracture of the skull in adults, but in infants the venous sinuses or veins entering the sinuses can be torn without fracture.

(3) *Hæmorrhage into the subarachnoid space.* This may be due to trauma, to spread of hæmorrhages which originally were in the cerebral

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[1] Trotter, Wilfred, *British Journ. Surgery*, 2 : 271, 1914.

[2] Gardner, W. J., *Arch. Neur. and Psych.*, 27 : 847, 1932.

[3] Baker, A. B., *Arch. Path.*, 26 : 535, 1938.

substance, to rupture of aneurysms on the superficial cerebral arteries, to inflammatory erosion of these arteries, to rupture of perforating branches as they leave the superficial arteries, to rupture of capillaries or small veins, to encephalitis, to blood diseases, or to toxæmia.

Trauma is the most common cause of subarachnoid hæmorrhage. It is then usually associated with contusion or laceration of the cortical substance, or with tearing of the membrane. The bleeding is rarely localised, but tends to spread widely over the surface of the brain into the sulci, and moves freely with the cerebro-spinal fluid.

The spread of hæmorrhage from the cerebral substance occurs not only when such hæmorrhage is in the superficial part of the brain, but also when hæmorrhage into the deeper part of the brain matter has escaped into the ventricles. It escapes from the ventricles into the subcerebellar and basal cisterns, through the roof of the fourth ventricle. A careful search for aneurysms must always be made when there is blood and clot in the subarachnoid space. Apart from slight aneurysmal dilatation in severe atheroma, cerebral aneurysms are due to congenital weakness, to infective emboli, or, very rarely to syphilis. Aneurysms due to infective emboli are usually present in the sulci on the convexities; the source of the emboli will be found elsewhere, in the great majority of cases in an ulcerative endocarditis in young subjects. Congenital aneurysms are a common, though often overlooked, cause of hæmorrhage into the subarachnoid space.[1] They may occur and may rupture when the cerebral arteries are otherwise healthy, and when there is no abnormality in the rest of the body. They may be multiple. When they rupture, the blood frequently escapes not only into the subarachnoid space but tears through the cerebral substance reaching the ventricles. Their commonest site is at the junction of the anterior communicating artery with one of the anterior cerebral arteries ; in this site they may only be revealed by separation of the lips of the anterior extremity of the great longitudinal fissure. They are, therefore, of great medico-legal importance for they may be the cause of death in cases in circumstances which might have given rise to suspicion of foul play, or their sudden rupture in the driver of a vehicle may be the real cause of a serious accident. In every case of subarachnoid hæmorrhage a careful dissection of the cerebral vessels especially in the Circle of Willis and branches from it must be carried out. The dissection should be carried out under water and the clot washed away with the greatest care. Injection of the vessels with a coloured dye may help in finding the source of the hæmorrhage. The superficial cerebral arteries, especially on the base, may be eroded by tuberculous or syphilitic inflammation. In the former case obvious tuberculous meningitis will be present ; in the latter, microscopic section may be required to prove the cause. Rupture into the subarachnoid space of perforating branches as they leave the superficial cerebral arteries is of very rare occurrence. It occasionally happens in cases of persistently high blood-pressure ; it is then a form of apoplexy, but hæmorrhage in apoplexy in the great majority of cases occurs from arteries within the cerebral substance. The following case shows that capillaries or small veins may rupture and cause large hæmorrhage into the subarachnoid space in a perfectly healthy man.

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[1] Symonds, C. P., *Quart. Journ. Med.*, 18 : 93 .1924.

A man, aged twenty, a cabinet-maker by trade, was taking part in a public oxing match. At the end of the second round he had received little punishment nd was winning handsomely. His seconds advised him to finish off his opponent n the third round. When time was called he sprang towards his opponent, but gradually collapsed forwards before reaching him. He was not struck before, or s he fell. He died soon after admission to hospital. At the necropsy fluid blood was found in the subarachnoid space diffused all over the cerebrum, three ounces of blood in subarachnoid space of the cord, an ounce of blood in each lateral ventricle and a small portion of clot in the fourth ventricle. The brain and other organs were healthy except for intense congestion. The only arterial disease was slight atheroma of the aorta. There was a superficial abrasion on the left malar bone, a bruise on the left forearm and a bruise on the right upper arm.[1]

Fits or whooping cough may give rise to hæmorrhage from venous congestion ; such hæmorrhages are usually small. In encephalitis small hæmorrhages may be present in the subarachnoid space. Their cause can only be proved by microscopic examination of the brain and cord. Hæmorrhages due to blood diseases, such as anæmia or purpura, are small, and their nature is explained by examination of the rest of the body. Small hæmorrhages may occur in poisoning, both endogenous poisoning, as in puerperal toxæmia, or exogenous, as in phosphorus poisoning.

(4) Hæmorrhage in the pia may be due to any of the causes of subarachnoid hæmorrhage ; it is then almost invariably associated with subarachnoid hæmorrhage. Hæmorrhages confined to the pia are small, and are commonly an integral part of the general injury to the brain after trauma. The pia is strongly adherent to the brain, so that it is only rarely that a clot forms. Such bleeding shows as a diffuse stain. They may be caused by encephalitis, diseases of the blood or toxæmia.

Hæmorrhage into the Cerebral Substance. (1) Capillary hæmorrhages are found in encephalitis, in softening due to arterial embolism (very rarely fat embolism), to arterial thrombosis or sinus thrombosis, to diseases of the blood such as anæmia and purpura, to septicæmia, to toxæmia of both endogenous and exogenous origin, to fits, or to violent coughing, as in pertussis.

The causes of such hæmorrhages are revealed by the examination of the contents of the cranial cavity, for instance emboli in arteries, or by examination of the rest of the body. Microscopic examination is required to diagnose fat embolism, and encephalitis in the absence of abscess.

(2) Large non-traumatic hæmorrhages in the cerebral substance are usually the result of rupture of a perforating artery. Large intra-cerebral hæmorrhages occasionally occur in cases of puerperal toxæmia, in which there have been no fits. A case is recorded of sudden death in an apparently healthy child from rupture of a congenital aneurysm into the substance of the left frontal lobe forming a large hæmatoma which ruptured into the ventricle.[2]

(3) A large hæmorrhage not infrequently arises from a glioma or angioma of the brain ; it may also arise from a secondary growth, particularly chorion epithelioma. It has already been stated that the cerebral substance may be torn up by blood from ruptures of infective or congenital aneurysms on arteries in the subarachnoid space ; rupture of arteries in the subarachnoid space when eroded by syphilis may also pour blood into the cerebral substance.

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[1] London Hospital, P.M., 849, 1913.

[2] Hermann, J., and Macgregor, A. R., *B.M.J.* 523, 1940.

When hæmorrhages result from rupture of a perforating artery there is either evidence of extreme degeneration of the cerebral arteries or evidence of previously existing persistently high blood-pressure. Usually there is evidence of both conditions. The hæmorrhages usually occur within the basal ganglia or pons, rarely in the cerebellum. When hæmorrhages occur in puerperal toxæmia, hæmorrhagic necroses will be found in the liver. Hæmorrhages arising in tumours are, as a rule, readily recognised, but large hæmorrhages are sometimes found arising near the surface of the cerebellar lobes in apparently healthy young people in whom there was no naked-eye explanation of the lesion, but in microscopic sections varicose, angiomatous veins, with imperfectly developed walls were found.

Traumatic hæmorrhages in the cerebral substance can be identified by exclusion of other causes and, particularly, by attention to the cardinal rules for traumatic lesions given above. It was mentioned that **an exception to these rules** has been noted thus : In a very few cases hæmorrhage within the central parts of the brain substance, particularly in the pons, results directly from trauma ; such a hæmorrhage is neither beneath a fracture nor in the position of a *contre-coup* lesion. In such cases it is a very difficult medico-legal question to decide whether an associated lesion in the scalp or skull is evidence of trauma which caused the hæmorrhage, or whether the scalp or skull were injured by a fall due to unconsciousness caused by a non-traumatic hæmorrhage. A traumatic hæmorrhage of this kind is, however, only caused by severe trauma. The lesion in question is apparently due to tearing of a vessel by an abnormal movement of the brain within the cranial cavity. If the arteries are healthy, and the heart affords no evidence of a previously existing persistently high blood-pressure, but there is evidence of severe trauma, then such a hæmorrhage is presumably traumatic. If, however, the vessels are degenerate, and they often are in these cases, other evidence than that obtained by necropsy may be required before an opinion can be expressed.

Disease plus Violence. It is now necessary to say something concerning hæmorrhages which could have resulted from disease alone, but in which violence may have been, or is alleged to have been, the final and actual cause. When disease of the following kinds is found, then a sudden rise of blood-pressure, due to excitement however caused (alcohol, scuffle, assault, etc.) may be the actual cause of hæmorrhage. The disease conditions are : cerebral aneurysms, severe degeneration of cerebral arteries, evidence of a previously existing persistently high blood-pressure, erosion by inflammation of a cerebral artery, pachymeningitis hæmorrhagica interna, and cerebral tumours, especially angiomata. If hæmorrhage arises from one of these disease conditions, and there is evidence of a scuffle or *post-mortem* evidence of violence, such as recent bruises on the body which cannot be explained by a fall due to unconsciousness, then it is impossible not to admit excitement as a possible ultimate cause of the hæmorrhage. Excitement can undoubtedly cause rupture of vessels when such disease is present. On the other hand, excitement and drunkenness are not sufficient to cause hæmorrhage when such disease is absent, unless such excitement is associated with extreme congestion. The effects of passion vary greatly in different individuals. In some people passion causes a condition very similar to that of a fit.

Fatal cerebral hæmorrhage is very rare, however, in even true epileptic fits. In medical evidence the effect of excitement has frequently been given an impossible value.

By a careful study of all the circumstances and *post-mortem* conditions it should be possible to arrive at a definite conclusion in the greater number of cases. In the remainder the *pros* and *cons* may be very evenly balanced, and the medical witness may be compelled to leave matters in doubt. The medical witness must remember that it is not his special business to obtain a verdict, but to give what evidence he can fairly do, and leave the result to the jury. The following propositions are warranted as representing facts deducible from the above discussion :

1. That multiple bruises of the brain are never found as the result of disease *only*, except when the disease causing them is *abundantly manifest from evidence derivable from autopsy*, or from the history, *e.g.*, scurvy, purpura, hæmophilia, encephalitis.

2. That a definite hæmorrhage (with evident clot) in the substance of the brain, or in the ventricles, is practically never the result of violence *only*, unless the violence has been sufficiently severe to leave manifest evidence of its infliction, but it is a very frequent result of disease alone, or of disease *plus* excitement, or disease *plus* slight violence, such as a fall on soft earth causing a fairly severe *shake* of the brain.

3. That the younger the patient, and the less inclined to intemperance, the rarer it is to find definite hæmorrhage or capillary oozing in the substance of the brain without evident violence ; but even in young subjects they may occur at times, *e.g.*, from violent cough, as in pertussis, or from encephalitis or angioma. They are not very uncommon in newborn children, as the result of difficult or premature labour (*vide* "Infanticide," Vol. II).

4. That meningeal hæmorrhages are usually the result of injury, but that they do occur from disease, and are occasionally spontaneous, or, at least, they are found in the absence of disease or trauma.

5. That a meningeal hæmorrhage from violence is always found, either immediately under the spot struck, or at the opposite side of the skull by *contre-coup*, or at some point in an extension of the fracture caused by the violence. When under the spot struck there is sure to be either a superficial bruise of the scalp, indicating the spot, or a fracture of the bones, or a very definite tear in the vessel causing the bleeding (usually the middle meningeal artery, or one of the sinuses of the brain running in the meninges). When from *contre-coup* there is sure to be in addition a bruise or laceration of the brain.

A medical witness may be asked whether vessels may be ruptured by excitement. If he answers, without any qualification, in the affirmative, the court may assume that excitement may have caused the rupture of the vessel in the particular case on which he is being examined. This impression on the court is not always removed even by a careful re-examination. A qualified answer should be given to what is really a general question ; and assuming his opinion to be already formed on the subject on which his evidence is required, he should not, unless it be strictly consistent with his own views, allow his answer to a *general* question to be made applicable to a *particular* case. If asked whether vessels might not be ruptured and blood extravasated by mere *excitement*, he should answer that such an effect might undoubtedly follow, but that it was his opinion—and it is here supposed that his opinion has been founded upon a deliberate examination of *all the medical facts*—that excitement was not the cause of rupture and extravasation in the case in question.

The following cases are illustrations of the above propositions and of the difficulties that may arise.

An inquest was held on a young woman, *æt.* 26, who was seen to fall suddenly in the street. *Post-mortem* revealed an ordinary cerebral hæmorrhage. She was at the time very excited and in a bad temper. In this case the woman was very young to have an attack of apoplexy from mere excitement, and probably the examiner did not observe the ruptured vessel with sufficient care to discover congenital aneurysm.

In *R. v. Portbury* a woman was charged with the murder of her mother. The mother died ten days after a quarrel with the accused. On inspection there was congestion of the membranes of the brain with slight effusion. There was nothing to indicate that this had been caused by violence, and the effusion, which was the cause of death, might have arisen from excitement, in view of the age and habits of the deceased. The accused was discharged.

In another case death was more rapid. The deceased, *æt.* 55, had presided at a meeting, and was engaged in an angry altercation, when he received a sharp blow on the cheek. He leaned over on his right side, but did not speak. He died in ten minutes. Both the deceased and his assailant were greatly excited. On inspection blood was found effused on the brain. The medical man properly referred death to apoplexy, as the result of excitement, and not to the blow which was struck.

In *R. v. Baker* several interesting points arose with respect to wounds and the cause of death. There were nineteen wounds upon the body of the deceased. Three of these were mortal wounds, *viz.*, one on the left side of the chest, penetrating the right ventricle of the heart, the bag of the heart being filled with blood ; a second wound at the lower part of the right side of the chest passed through the liver into the inferior vena cava, and had caused copious hæmorrhage ; a third wound had opened the left internal jugular vein. The other wounds were of a minor nature. There was no existing disease. Over the surface of the brain was a considerable effusion of blood extending into the ventricles.

This was ascribed by Pepper to apoplexy, probably the result of a violent struggle ; and he assigned apoplexy rather than the mortal wounds on the body as the cause of death. In view of the copious hæmorrhage from the mortal wounds, which probably continued for some time after death, the presence of an effusion of blood upon the brain was remarkable. Probably the mortal wounds had been inflicted after the apoplectic seizure, and whilst the man was in the act of dying.

In a trial for manslaughter it was proved that the prisoner and the deceased had been wrestling. The prisoner had thrown the deceased with his head on a stone floor ; he then seized him by the throat, and beat his head several times against the floor. The deceased died nineteen hours afterwards. On inspecting the body a great quantity of coagulated blood was found beneath the scalp. There was a wound over the right parietal bone, an inch and a half in length, penetrating through the scalp, but no fracture of the skull. There was a quantity of extravasated blood on the opposite or left side of the head, and a rupture of some vessels on the inside of the skull. On the neck were two discolorations to the left of the windpipe, apparently occasioned by the pressure of two fingers.

The surgeon, after giving this description of the *post-mortem* appearances, was asked whether, in his opinion, death was occasioned by the injury. He replied, " Death might or might not have been occasioned by it." This is the sort of answer that brings the medical profession into ridicule. In another case the judge was strong enough to expose such nonsense. The judge said :—

> If it were proved that two people were fighting together, blows were struck, one fell to the ground and died, and afterwards internal injuries were found corresponding with the external marks of violence, no power on earth could persuade him that such blows were not the cause of death. The prisoner was found guilty.

There is a clinical point of interest in connection with intra-cranial hæmorrhage, *viz.*, that when apoplexy (to use a comprehensive term) seizes a person who is at the moment pursuing his ordinary and accustomed vocation without excitement or drink or unusual exertion, it frequently clears up so far that the patient does not die, but lives for months or years in a more or less paralysed condition. In those cases in which violence plays a part, a fatal result is much more frequent. Hence, if it were proved that the violence were not great and that there were signs of previous hæmorrhage, such a fact might be pleaded in mitigation of punishment.

In this respect *R. v. Sullivan*[1] is of some interest :—

> On April 11th an apparently healthy man was knocked down by the prisoner, and fell with his head upon the ground. Although he suffered from pain in the head, he had no medical advice until May 12th, and had in the meantime performed his duties. On the 29th May he came under medical care. There were marks of bruises on the head, impairment of vision, a faltering gait, and other symptoms indicative of disease of the brain. About June 12th he became insane. He recovered so far that he was about to be discharged, when the symptoms became aggravated, and death took place *four months* after the infliction of the violence. On inspection a clot of blood amounting to two fluid ounces was found between the layers of the arachnoid membrane, occupying the whole surface of the left hemisphere ; the clot had evidently been there for some time. The surface of the brain had been obviously indented by its pressure. Another clot of old standing was found in the pons Varolii. The medical witnesses concurred in attributing death to the effusion of blood on the brain and the effusion to the violence inflicted by the prisoner, although they stated that some additional effusion had probably taken place just before the last recurrence of symptoms. The prisoner was convicted of manslaughter.

Such cases today do not present quite so much difficulty, for meningitis, pachymeningitis, cerebral abscess and other pathological conditions of the brain, with or without hæmorrhage, are well-recognised consequences of injury to the head. Death may occur after a long period of illness or ill-health, or after a period of apparent recovery. It is well recognised that a person may receive an injury to the head which may eventually lead to a fatal issue but which may not produce any grave symptoms at the time of its infliction.

In connection therewith it is important for a pathologist to be acquainted with the changes that time produces in effusions of blood within the cranium, and the histological changes in the cerebral tissues after damage to the brain.[2] [3]

Recent effusions of blood are recognised by their red colour and the consistency and appearance of the clot or coagulum. After some days the clots acquire a chocolate or brown colour, and this passes gradually into an ochreous tint, which may be met with in from twelve to twenty-five days after the violence. Clots of effused blood also undergo changes in structure and consistency ; when old they are firmer and there is much lymph, which is sometimes disposed in membranous layers of a fibrous structure, and these are adherent to the dura mater and the brain. The surface of this organ presents a mark indicative of pressure.

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[1] C.C.C., September, 1853.

[2] Linell, E. A., Arch. Neur. and Psych 22 : 926, 1929.

[3] Rowbotham, G. F., Acute Injuries of the head, 2nd Edition 1945.

The following case, however, shows the necessity for caution in stating the exact date of an effusion of blood.

A woman, *æt.* 70, threw herself from a window. The fall produced a severe lacerated wound of the scalp, laying bare the skull, and causing a simple fracture of the sternum and tibia. She died thirty-one days after the injury. On inspection there was a fracture of the left parietal bone, and between the dura mater and inner surface of the skull, near the left temple, there was a layer of coagulated blood, one-sixth of an inch in thickness and about two inches in breadth. In one place the clot had a brownish hue, but the greater part of it was still rather dark-coloured. On the right side there was a similar effusion of coagulated blood, but this was inside the dura mater and on the arachnoid covering of the brain or within the cavity of the arachnoid. This coagulum was everywhere of a *chocolate-brown* colour, showing that the process of absorption was much more advanced than on the left side. A large quantity of coagulated blood had been effused into the cellular tissue near the fracture of the tibia. This was still black and had the appearance of a recent effusion. A small quantity of black blood was also found near the sternum, which had been fractured. The fractured ends of the bones had been firmly united. There is no doubt that all these effusions had taken place at the same time from the same accident—*i.e.*, thirty-one days before death—yet they presented very different appearances ; and but for the facts being known it might have been contended that the effusion on the arachnoid from the great change of colour was of much older date than the others. The difference, however, was probably owing to absorption being more active on the inner surface of the serous membrane than in the other structures in which blood was effused. In estimating time, as indicated by change of colour in the clot, we must therefore always consider the seat of the effusion and the absorbing power of the tissues.

In cases of injuries to the head proving fatal by effusion of blood into or on the brain, a person may recover from the first effects of the violence, and apparently be going on well, when he will suddenly become worse and die. Effusion takes place slowly at first : it may be arrested by the effects of stupor from concussion, by a portion of the blood coagulating around the ruptured orifices of the vessels, or by some other mechanical impediment to its escape ; but after a longer or shorter period, especially if the person be excited or disturbed, the bleeding will recur and destroy life by producing such compression. How many hours or days are required in order that such an increased effusion should take place after an accident it is impossible to say, but in severe cases it is generally observed to follow the injury within a short time.

This is in fact one of the recognised methods of distinguishing between concussion and definite gross meningeal or even intracerebral hæmorrhage. In the former unconsciousness appears at once and remains till the end or gradually disappears as the patient recovers ; in hæmorrhage, on the other hand, there may be a momentary unconsciousness followed by a speedy recovery, so much so that the patient resumes his occupation, for a longer or shorter period, minutes, hours, days or even weeks, and if then unconsciousness returns, death soon follows. The two following cases are quite typical and could be multiplied to any degree.

A gentleman was thrown out of a chaise, and fell upon his head with such violence as to stun him. After a short time he recovered his senses, and felt so much better that he entered the chaise again, and was driven to his father's house by a companion. He attempted to pass off the accident as of a trivial nature, but he soon began to feel heavy and drowsy, so that he was obliged to go to bed. His symptoms became more alarming, and he died in about an hour from effusion of blood on the brain.

In another case, as a result of effusion of blood from injury to the head, death did not take place until the twelfth day. The patient, *æt* 18, received a blow on the head during a fight. He did not suffer much in consequence, and continued his employment during the next ten days, but on the eleventh day, owing to his having headache, he went to the hospital. He died during the night. On inspection bruises were found on the arms, but the head presented no outward sign of injury, and the bones were not fractured. The right half of the brain was surrounded by effused blood, which had compressed it. It was contained in the cavity of the arachnoid membrane. The brain presented no breach of surface or laceration from which the blood could have issued, and its substance was healthy. There was a loose coagulum of slightly brown hue, and under this there were other coagula of a light ochreous colour adherent to the brain and dura mater, showing that the blood had been effused some days. These coagula were in membranous layers, and under the microscope presented a fibrous texture.[1]

In this connection the following case is interesting and instructive.

A man, *æt.* about 50, worked in the morning, and from about midday till 4.30 he sat in a public-house chatting and having an occasional drink. About 4.30 he mounted his cart to drive home. He drove in such a manner as to attract two neighbours from their work to stop the horse; they stopped it somewhat suddenly, and the man fell off the shafts on his face in the road. After this he had two, or possibly three, more falls, but finally was put into his cart with the local policeman to drive him. The policeman left him about 5.50, as he then seemed more himself and capable of driving. Within a few minutes he met a traction engine. He waved to the driver of the engine to stop and then got down and walked with his horse, which got more and more restive and finally bolted, pulling the deceased over and throwing him violently to the ground, the cart passing over him. He was picked up dead by the men on the traction engine.

An inquest was held, and a *post-mortem* examination was made, with the following results: There was an abrasion on one malar bone, quite superficial: there were no other external injuries at all; internally there was found a clot of blood between the meninges and the brain, and the aorta was somewhat atheromatous. Nothing else was found to which death could be attributed.

Damages were claimed by the widow against the owners of the traction engine.

The legal points need not be mentioned, but the medical evidence is of interest and may be thus summarised:

The evidence for the widow was that the man was somewhat under the influence of alcohol; that he was then violently shaken by his final fall and died at once of shock from this fall.

The evidence for the owners of the engine was that the man was somewhat under the influence of alcohol and excitement; that these, combined with the admitted falls (antecedent to the fatal one) started a meningeal hæmorrhage, which, after reaching a certain degree, ceased at that degree, until the excitement of the attempt to stop his horse and the violence of his fall caused it to recommence and increase and so to bring about death by compression.

The judge awarded the widow £100 damages, but he gave no reasons for his decision. It was obviously very difficult to decide whether the hæmorrhage was the result of the fall from the cart or from the subsequent injury from the bolting horse. There was, however, an interval of two hours between the first fall and the death, whereas death occurred immediately after the second fall. A careful histological examination of the clot and injured brain tissue might have enabled the examiner to give a decisive opinion, but in the absence of such evidence it was impossible to be sure and the judge no doubt gave the benefit of the doubt to the injured party.

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[1] Guy's Hosp. Rep., 1859, P. 123.

Fractures of the Skull

There are certain points about fractures of the skull with which it is necessary for a medical witness to be familiar, for they will throw much light on the nature of the weapon used, the method of infliction of the injury, and whether it was due to accident, suicide or homicide.

1. With **pointed weapons,** or with weapons the striking surface of which is small in proportion to the momentum of its impact, such as the blunt end of a hammer, the shape of the depression on the outer surface frequently corresponds pretty closely to the shape of the contact area of the weapon ; or a local starred fracture is produced, which may or may not extend beyond the area of depression.

2. **Splintering of the Tables.** In local fractures the table of the skull which at the moment of impact is farthest from the force is splintered to a larger extent than the table nearer the force, owing to the fact that it is, *quâ* the force, unsupported. This fact enables us to ascertain the direction in which a solid object has passed through the skull, the fracture of entrance having the inner table, the fracture of exit having the outer table, more extensively splintered. The direction, too, in which the splinters are bent corroborates the inference.

3. If such a starred local fracture has a limb extending from the locality, such limb will follow the rule in the next paragraph.

4. With forces the contact area of which is broader—falls on the head, crushes of cart wheels, blows of bludgeons, falls on the feet (the condyles being the point of transmission of the force) are the commonly occurring examples—the rule is that **the line of fracture is parallel to the line of direction of the crushing force,** most frequently starting from the point of contact. Thus a blow on the side of the head produces a fracture running across the base and over the vertex from side to side. Similarly an antero-posterior fracture, either sagittal or oblique, is produced by a force acting in the saggital or oblique plane, as the case may be.

5. If the head be supported, and so prevented from moving, the **fracture may start at the point of contact of the blow, or at the opposite point** where the head was supported ; for example, in falls on the vertex the fracture may have begun either at the vertex or at the base.

It is obvious that the greater the violence, as in train and other smashes, the more difficult it is to trace these lines of fracture.

When the force causing the fracture has a broad area of contact it is important to remember that there may be extensive fracture and separation of the bones of the head without any division of the skin.

A blow on the head may produce a fracture of the inner table of the skull, and cause death by compression as a result of the fracture or of the effusion of blood.

In *R. v. Hadwen*, the prisoner struck a boy a severe blow on the head. He became sick and unconscious, fell into a state of collapse, and died the next day. On inspection the inner table of the skull was found to be fractured, and there was effusion of blood on the brain.

The orbits are very common situations for small starred fractures of the skull due to direct penetrating violence. A stick, a gimlet, a pair of scissors, a birch broom (points of), a tobacco pipe, a penholder, have all been recorded as producing such fractures. The bone between the orbit and the brain is very thin, and in young persons especially, is very easily perforated. In all cases of fracture the thickness of the skull should be noted, for though it may not, and does not, absolve an assailant from responsibility, the fact that the skull was unusually thin may affect the medical witness's opinion as to the severity of the violence, whether criminal or accidental.

Was the Fracture due to a Blow or to a Fall ?—This point has important applications in legal medicine, for there are many cases in which this is the principal question tried in court. Injury may occur from violence with or without fracture, and it may take place without being accompanied by any external marks of the violence.

It is true that the Offences against the Person Act, 1861, uses the words : " by any other means whatsoever cause grievous bodily harm " ; nevertheless, when there is evidence simply of a general scuffle, the punishment inflicted is likely to be materially influenced by the answer to the question above propounded. Take the following not unusual circumstances : The deceased is annoying and following the accused ; the accused turns around and pushes (he says), strikes (says the prosecution), the deceased, who falls and dies speedily from head injury. Although the evidence of a blow or push may be conflicting, it may be very material for the purpose of awarding pubishment.

The answer is by no means easy, and in general the medical witness will be compelled to admit that the injury might have arisen from the fall. The following points may, however, help materially to a conclusion :

1. The **nature of the area of ground** upon which the head was alleged to have fallen, soft earth, for instance, or a hard flagstone. If on soft earth, was there a sharp stone or brick or other hard substance with which the head could have come in contact ?

2. **How did he fall**—forwards, backwards, or sideways ? Does the position of the injury on the head correspond with direct violence, which might have been sustained by a blow either of a fist or weapon, or does it more nearly correspond with the direction of the alleged fall ?

3. The **number and nature of the injuries.** If a fight is admitted, many of these may be due to it, but if only one blow, or none, is admitted, then the fall may not be sufficient to account for the injuries.

4. **The position of the injury.** In a simple fall it is almost impossible for the vertex to be injured unless the victim is knocked down when standing about his own height from a wall, and in the fall thus brings the top of his head against the wall.

The following cases are inserted to give some idea of the gross lesions which may sometimes be inflicted without causing the immediate death of the patient :—

The American Crowbar Case. Whilst engaged in blasting operations a smooth iron rod, three feet seven inches long and one and a quarter inches in diameter, having a tapering point and weighing thirteen and a quarter pounds, passed completely through the head of Phineas P. Gage, aged 25 years. The rod entered the skull in the temporal fossa and emerged where the two parietal bones join the frontal bone. There was much hæmorrhage and escape of brain matter. The patient spoke a few minutes after the accident, and gave an account of how the accident happened. He had a long illness, but nine or ten weeks later he could walk, and eventually recovered all his faculties of body and mind, with the loss only of the injured eye (*viz.*, the left, which was protruded at the time of the accident).[1]

Stab Wound of the Brain.[2] A case occurred in Madras in which a man was stabbed in the forehead with a knife with such force that the entire blade, four and a half inches long, penetrated the head. The stab wound was one inch long and one-eighth of an inch broad; it was situated above the inner end of the right eyebrow, and the corresponding portion of the frontal bone was fractured. The blade had passed deeply into the brain, and survival seemed impossible, though the man, when admitted to hospital, was talking rationally. The knife was removed only with great difficulty at the end of half an hour. After being treated for forty days perfect recovery resulted.

Penetration of Brain by Iron Rod.[3] A boy, aged fourteen years, was running along a workshop with a long iron rod in his hand, when he tripped and fell and the rod penetrated his cheek. He pulled it out himself.

The wound was dressed by a medical man, who referred him to the infirmary for subsequent treatment. He seemed dazed after the accident. On the next day he presented himself at the casualty department with a septic inflamed wound in the right cheek, and whilst waiting to be attended to he seemed unable to keep awake. This attracted the attention of the casualty officer, and the boy was admitted. Beyond a slight elevation of temperature and marked drowsiness there was an entire absence of symptoms. When roused he would sit up and answer intelligently but in an apathetic way any questions addressed to him, and as soon as they were discontinued he would drop down in bed and fall asleep at once. He would feed himself, but would go to sleep between the mouthfuls. Four days later he was sent home, but a convulsion occurred and the lad died the next day.

It was found that the rod, after penetrating the cheek, had passed inside the zygomatic arch, and through the great wing of the sphenoid. It entered the brain near the apex of the right temporo-sphenoidal lobe and, with an inclination inwards, passed through the posterior part of the frontal lobe and ended on the convexity close to the longitudinal fissure.

For other points *vide ante* under the heading "Accident, Suicide or Homicide?"

Wounds of the Face

When wounds of the face are of any extent, they are usually followed by great deformity; and when they penetrate the cavities in which the organs of the senses are situated, they often prove fatal, either by involving the brain and its membranes or by giving rise to inflammation of this organ. In this respect the face closely corresponds to the scalp; in fact, the supraorbital region of the scalp is as dangerous as any other wound of the scalp. Amaurosis or blindness is an occasional sequel of blows of the face, probably due to rupture of the retina. The war has provided numerous examples of blindness without obvious external injury, but with hæmorrhage into the vitreous, ruptures of the retina and choroid, etc., to account for it. The explanation appears to be that the deep injury is due to compression of the eyeball by force of explosions or blows on the face.

Wounds of the Nose

These wounds are, generally speaking, of a simple nature, rarely giving rise to serious symptoms; but they are often attended with great deformity. If the injury is a contusion and, at the same time, extensive, a loss of the sense of smell with probably result. A penetrating wound of the nose, produced by passing a sharp-pointed instrument up the nostrils, may destroy life by perforating the cribriform plate of, the ethmoid bone and injuring the brain. Such a wound, it is obvious, might be produced without leaving any external marks of injury. A man died in nine weeks from the effects of a wound of the nose, whereby the nasal bones were fractured. On inspection there was a copious inflammatory effusion at the surface of the brain, particularly at the part corresponding to the seat of the violence.

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[1] *American Jour. of Medical Science*, Vol. 20, 1850.
[2] *B.M.J.*, September 19th, 1925.
[3] *Lancet*, June 1st, 1907.

INJURIES TO THE SPINE

Injuries to the spine and spinal marrow seldom require medico-legal investigation from a criminal point of view, but they are very common in civil cases, especially under the Workman's Compensation Act. The spinal cord is liable to *concussion* from blows, to compression from fracture of the vertebræ or the effusion of blood, with all the secondary consequences attending such accidents. Concussion of the spinal marrow commonly produces paralysis, affecting the bladder, rectum, or lower extremities. These symptoms, may not appear at once, but come on after some hours or days. It is quite possible to have a momentary dislocation of the spine, especially in the cervical region, causing pinching of the cord followed by immediate replacement. In such circumstances the person may die suddenly or may survive with clinical signs of nerve injury, depending on the site of the temporary dislocation. Many of the cases of " concussion " are no doubt due to such luxations or displacements, causing contusion of the cord or its nerve roots. The pathological examination of the cord may show an area of hæmorrhagic spots on the surface or in the substance of the cord, or there may be larger effusions of blood. Blows on the spine, unattended with fracture or dislocation, may be followed by inflammation and softening of the spinal marrow, and in certain cases the pathological effects of an injury may not show themselves for some time after the injury. A slight injury has been known to cause death by giving rise to inflammation of the spinal marrow. This organ is also liable to compression from slight causes.

A man was tried on a charge of manslaughter. It appeared in evidence that he had thrown the deceased on the ground, and while he was attempting to rise he caught him by the throat, forced him backwards, and brought his head violently in contact with the ground. The deceased died after a few convulsive gasps. On inspection the spinal cord was found to be compressed between the body of the fourth and the arch of the third cervical vertebra, but on removing it no indentation or laceration of its substance was perceptible. Death had ensued from paralysis.

This case shows the necessity for inspecting the vertebral column when death is alleged to have been caused by violence, and no traces of it are perceptible in other parts of the body. Indeed, it is not improbable that in many cases of death from alleged or suspected violence, where the cause is obscure, if the spinal marrow were examined, the fatal result might be explained by the discovery of some mechanical injury or morbid change in this organ. This part of a medico-legal inspection is too commonly neglected.

The extremely variable and often very puzzling results of violence applied directly or indirectly to the spinal column and cord can be rendered tolerably intelligible to a layman by a few brief paragraphs on the **anatomy and physiology of the cord.**

1. There is a thick covering of muscle and other structures running up the back which breaks and distributes the violence of direct blows, forming an excellent first line of defence.

2. The spinal canal formed by the bony arches of the vertebræ is much larger than the cord itself, the intervening space being filled with fat and connective tissue; hence there is room for considerable displacement of bone before pressure on the cord itself reaches a serious degree. Similarly with effusions of blood: they can reach a considerable size before the cord is badly pressed upon or compressed.

3. The cord is not only protected by this padding, but is slung, so to speak, by stays reaching from the bone to its meningeal covering: the nerves running from the cord out through bony canals are additional stays serving the same purpose; hence it is difficult to shake the cord in the canal by any slight violence.

4. In structure and function it may be compared to a complicated telegraphic system of wires and stations, the wires connecting the brain or head central office with the subsidiary offices contained in the cord itself, these latter consisting of collections of neuron cells, which are now mapped out with considerable accuracy, *e.g.*, bladder and rectal centres, probably also other visceral centres and centres for limb movements, etc. Each primary or main path to or from the brain is linked up with several subsidiary centres; hence the higher up the cord is damaged the greater the disturbance caused, entailing even sudden death when respiratory or cardio-vascular connections are broken, as when the odontoid process presses on the medulla.

Fractures of the Vertebrae. These fractures are generally attended by displacement, and thus produce compression of the spinal marrow. The whole of the body becomes paralysed below the seat of injury by the compression of the spinal marrow. If the seat of compression is above the fourth cervical vertebra death is usually immediate, asphyxia resulting from paralysis of the nerves which supply the diaphragm, and are necessary to respiration. In falls on the top of the head from a height, it sometimes happens, not only that the skull is extensively fractured, but that the odontoid process of the second vertebra is broken off, owing to the head being doubled under the body. This injury to the second vertebra may be the cause of death. This accident is not always attended with fatal compression of the spinal marrow. In *R.* v. *Reid* it became a material question how far such a fracture might result from disease. It may happen that caries of the bone, or disease of the transverse ligament, may cause a separation of the odontoid process from the second cervical vertebra. The state of the bone in an alleged fatal accident should therefore be closely examined. In Reid's case an acquittal took place, partly because the diseased had suffered from disease of the spine, and the exact state of the parts had not been noticed. A slight cause may sometimes produce severe and fatal injury to the neck by displacing the odontoid process.

A patient in a mental home suddenly threw her head back, in order to avoid taking some food that was offered to her; and died evidently from the compression produced by the displacement of the dentiform process of the second vertebra.

A woman died suddenly a month after her confinement; she had been suckling her child at one o'clock in the morning, and at four she was found dead. The viscera of the abdomen, chest, and head were carefully examined without the discovery of any morbid appearance to account for her death, when, as the brain was being returned into the skull, one of the inspectors noticed a projection at the foramen magnum. On further examination the dentiform process of the second vertebra was found to have been displaced, and this had so injured the spinal marrow as to cause death.

A man died suddenly while holding his head in a butting position during a struggle with a friend. The friend had forcibly rotated or twisted the deceased's head a few times from side to side by the brim of his hat. On inspection it was found that the first four cervical vertebræ were fractured—the ligaments were bruised and torn, and blood was effused on the coverings of the spinal cord.

It is not stated whether there was any disease of the bones. Compression of the spinal marrow sometimes arises, though rarely, from *effusion* of blood from a fall. It is important to remember that an effusion of blood, or pus and caseous deposits, may also take place from disease.

Injuries to the spine and its contents are generally the result of falls or blows either on the head or the lower part of the column, or of crushes beneath heavy weights, as in navvies and housebreakers, etc. The secondary consequences of these injuries are sometimes so insidious as to disarm suspicion, and death may take place quite unexpectedly some weeks after the accident. Splinters of bone, separated by fractures, may remain adherent for some time, and, by a sudden turn of the head, be forced off, and destroy life by penetrating the spinal marrow at a period long after the infliction of the injury. This has been known to happen to fractures involving the margin of the foramen magnum, though in such cases death is usually immediate.

The **spinal cord** has been in some instances **wounded** in its upper part by sharp-pointed instruments introduced between the vertebræ. Death is sometimes an instantaneous result when the wound is above the third cervical vertebra; there is no part of the spine where a weapon can so easily penetrate as this, especially if the neck be slightly bent forward. The external wound thus made may be very small, and if produced with any obliquity by drawing aside the integuments, it might be easily overlooked, or it might be considered superficial.

In fractures of the vertebræ, a person is generally so disabled, whatever may be the situation of the fracture, that he cannot walk or exert himself. We must be prepared, however, for exceptions to this.

A man, *æt.* 35, was admitted into the Northampton Infirmary suffering from paralysis of the legs and great pain in the back and in the abdomen. He could give no intelligible account of the cause of his illness. He soon died; and on a *post-mortem* examination the tenth dorsal vertebra was found broken in its body and arch. There was slight displacement, but it was not such as to press upon the spinal cord. A large clot of blood was situated on the sheath of the cord, and had caused the paralysis. It was proved at the inquest that deceased met with a heavy fall, but that he had walked some distance afterwards, visited several public-houses, gone home intoxicated, and laid down to sleep in a yard. He awoke in the morning sober, but was unable to move his legs. There is no doubt that the effusion of blood was the cause of the paralysis, and this did not occur until some time after the fracture, as the result of slow oozing.

A few further remarks on spinal injuries will be found under "Insurance," and under "Drowning."

WOUNDS OF THE CHEST

Wounds of the chest have been divided into those which are confined to the walls and those which penetrate the cavity. Incised wounds of the chest-wall which do not penetrate the cavity are rarely followed by dangerous consequences. The bleeding is not considerable, and is generally arrested without much difficulty. They heal either by *primary union* or after suppuration, and unless their effects are aggravated by incidental circumstances, the person recovers. Contusions or contused wounds of the chest are, however, far more dangerous, and the danger is in a ratio to the degree of violence used. Such injuries when severe are ordinarily accompanied by fractures of the ribs or sternum ; by a rupture of the viscera within the cavity, including the diaphragm ; by contusion or other damage to the lungs or heart ; by profuse bleeding ; or, as an after-effect, by inflammation of the lungs with or without suppuration. Fractures of the ribs are dangerous for several reasons : the bones may be splintered and driven inwards, thereby wounding the lungs or heart and causing hæmorrhage or leading to inflammation of the pleura or lungs. In fractures of the upper ribs the prognosis is less favourable than in those of the lower, because commonly a much greater degree of violence is required to produce the fracture. A simple fracture of the sternum or chest-bone without displacement of the bone is rarely attended with danger, unless the concussion has at the same time produced mischief internally, which will be known by the symptoms. When, however, the bone is depressed as well as fractured, the viscera behind may be seriously injured.

In a case of depressed fracture of the sternum, the patient died after the lapse of thirteen days ; and on inspection it was found that the fractured portion of bone had produced a transverse wound of the heart about an inch in length. The cavities of the organ had not been penetrated, but the piece of bone was exactly adapted to the depression produced by it on the heart.

Wounds penetrating into the cavity of the chest are generally dangerous, even when slight, in consequence of the numerous accidents with which they are liable to be complicated. In these wounds, the lungs are most commonly injured ; but, according to the direction of the weapon, the heart or the great vessels connected with it, as well as the œsophagus (gullet) and the thoracic duct, may share in the mischief. Penetrating wounds from external sources are much more dangerous with reference to septic infection than wounds caused by the broken ends of ribs or sternum.

WOUNDS OF THE LUNGS

The immediate cause of danger from wounds of these organs is the consequent hæmorrhage, which is profuse in proportion to the size of the wound and the size of the vessels wounded. Should the weapon divide any of the trunks or main branches of the pulmonary vessels, the individual may speedily die. The degree of hæmorrhage cannot be determined by the quantity of blood which escapes from the wound ; for it may flow internally, and collect within the cavity of the pleura, impeding respiration. This is especially to be apprehended when the external orifice of the wound is small and oblique, and one of the intercostal arteries has been touched by the weapon. A wound of the lung is generally known, among other symptoms, by the frothiness and florid colour of the blood, which issues from the orifice, as well as by the expectoration of blood. Compression of the chest may cause bruising of the lung, laceration of its substance, or considerable ruptures with or without external evidence of violence. The detonation of high explosives causes "blast effects" in the lungs which are characterised by the presence of hæmorrhages into the lung tissue, intense capillary congestion, distention and rupture of vesicles.[1] [2] These are produced by the wave of compression which strikes the body with considerable violence. Hæmorrhages and lacerations are also found in the abdominal viscera, in the central nervous system and in the muscles. The suction effect of the wave of low pressure following the blast is not likely to be an important agent in the production of these injuries. Blast is merely a severe and swiftly acting external trauma.[3] [4] The lungs may sustain serious injury from a blow or fall, and yet there may be no external marks of violence or symptoms indicative of danger for some hours.

A young man while riding his horse fell on his left arm. He did not complain of pain for five hours, but in twelve hours he was seized with an alarming flow of blood from the mouth. He died in the course of a few days. After death there was no external mark of injury to the chest, but the right lung was ruptured posteriorly throughout its length, and much blood had been effused.

A boy, aged fourteen, fell to the ground from a height of about twenty feet, and died in about three hours after the accident. On examination of the body there was no mark of external injury. The collar-bone was fractured, but the ribs had escaped injury. The right lung was ruptured to the depth of four inches into its substance, and from this rupture a large quantity of blood had escaped, causing death.

This case furnishes another illustration of the production of fatal internal injuries without any corresponding marks of violence externally. The surgeon should observe whether death, when it occurs during the convalescence of a person who has survived the first effects of a penetrating wound of the chest, may not have been caused either by imprudence on the part of the patient or by abuse of regimen or other misconduct; for circumstances of this nature may be occasionally treated as mitigatory on the trial of the assailant.

A soldier died instantaneously from internal hæmorrhage, brought on by throwing a bowl at some nine-pins, two months after he had been apparently cured of a wound of the lungs. This giving way of an old healed wound is a well-known occasional accident in any region of the body that can be subjected to a strain.

Death in injuries to the lungs may be rapid from asphyxia due to hæmothorax or inhalation of blood into the alveoli. Other complications are pneumothorax, emphysema, air embolism, or, after a period, pleurisy, empyema, lung abscess or pneumonia.

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[1] Hadfield, G., and Christie, R., *B.M.J.*, 1 : 77, 1941.
[2] Ross, J., *B.M.J.*, 1 : 79, 1941.
[3] Tunbridge, R. E., and Wilson, J. V., *Quart. Jour. Med.*, 36 : 169, 1943.
[4] Zuckerman, S., *Lancet* 2 : 219 1940.

WOUNDS OF THE HEART

Wounds of the heart are among the most fatal of penetrating wounds of the chest. It was formerly considered that all wounds of this organ were necessarily and instantly mortal, a view which must now be considerably modified, for many cases have been operated upon with complete success. Sir Charles Ballance[1] tabulated 152 cases of operations performed on the heart and pericardium in consequence of injuries, a number of which recovered. Freese (*Jour. Amer. Med. Ass.*, February 19th, 1921) records a case in which recovery took place after transfixion of both ventricles by a stab. When the wound is small and the weapon penetrates into the cavities of the heart obliquely, life may be prolonged for a considerable period ; and cases are on record in which it is probable that such wounds would have healed, and the patients have finally recovered, but for the supervention of other diseases which destroyed life.

Dupuytren has reported the case of a man who received a stab on the left side of the chest. The symptoms under which he laboured did not lead to the suspicion that he had received a wound of the heart. The man died in eight days, of cerebral disease. On an inspection of his body it was found that the left ventricle was wounded about the middle and a little to the right, its cavity having been penetrated in a transverse direction. The external fibres of the organ were most separated: the openings diminished gradually, so that the internal fibres were in contact and closed the wound. A boy, in pulling a knife from a companion with the point towards him, accidentally stabbed himself in the chest. A small quantity of florid red blood escaped ; he vomited, and fell to the ground. He died in eight days. The left ventricle had been perforated, and one pound and a half of blood was effused in the chest. The case shows that fatal hæmorrhage is not always immediate. In another instance, reported by Dupuytren, five or six wounds were made by means of a saddler's needle, most of them penetrating into the left ventricle of the heart. The man died of cerebral disease twenty-five days after the wounds could have been possibly inflicted ; for the needle was taken from him twenty-five days before his death, without any suspicion being entertained of his having wounded himself with it. The cicatrices were visible on an inspection of the body.

From a series of cases collected by Ollivier and Sansom it appears that out of twenty-nine instances of penetrating wounds of the heart only two proved fatal within forty-eight hours. In the others death took place at the varied periods of from four to twenty-eight days after the infliction of the wound. These differences in the time at which death occurs, as well as the fact that wounds of the heart do not immediately cause death, have been ascribed to the peculiar disposition of the muscular fibres of the organ, and to the manner in which they are penetrated by a weapon. Thus, as a general principle, wounds which are parallel to the axis of the heart are. *cæteris paribus*, less rapidly fatal than those which are transverse to its axis. In a wound which divides the fibres transversely, the opening will be larger. and the hæmorrhage greater, than in one that is parallel to these fibres ; and as the heart is composed of different layers of which the fibres pass in different directions, so in a penetrating wound of its cavities, while one set tends to separate the edges, another tends to bring them together, and thereby to restrain the flow of blood. It is this action of the fibres which renders wounds of the ventricles less rapidly fatal than those of the auricles, all other circumstances being equal.

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[1] Bradshaw Lecture, December 11th, 1919.

A man has been known to survive a laceration of the left auricle eleven hours. In this case the chest was crushed, and after death it was found that the left auricle was lacerated to the extent of an inch; nevertheless this patient survived the injury for the long period mentioned. In another instance, where a man was stabbed through the left auricle during a quarrel, death did not take place until after the lapse of seventy-eight hours.

The presence of a weapon in the wound, by mechanically obstructing the effusion of blood, also retards the fatal result.

A lunatic wounded himself in the left side of the chest. Two days afterwards he was admitted into hospital. The wounded man stated that he had plunged the instrument into his chest, and had not been able to withdraw it. His symptoms became more aggravated, and he died on the twentieth day after the infliction of the wound. The pericardium and the surrounding parts were found inflamed. After opening the heart an iron stiletto was discovered, firmly embedded in the substance of the left ventricle, which it had entirely traversed. so that its point projected slightly into the cavity of the right ventricle.

Two cases have been published in which projectiles were found embedded in the wall of the left ventricle, eleven years after the injury. In both cases the men were leading active lives.[1]

It appears that the right cavities of the heart are more frequently wounded than the left, and of these the right ventricle is most commonly the seat of injury. Out of fifty-four cases of wounds of this organ, twenty-nine were situated in the right ventricle, twelve in the left ventricle, nine in the two ventricles, three in the right auricle, and one in the left auricle. These differences are readily accounted for by the relative situations of the cavities. It is considered that the rapidity of death in severe wounds of the cavities of this organ is to be ascribed not merely to the loss of blood, but to the degree of compression which the heart experiences from that which escapes into the pericardial sac. In reference to the *direction* of penetrating wounds of the chest it may be stated that the base of the heart corresponds to the upper margin of the third rib on the left side and the apex to the lower margin of the fifth rib on the same side.

Ruptures of the Heart. The heart is liable to be *ruptured* either from disease or accident. In the latter case, the organ generally gives way towards the base, and through one of its cavities on the right side. In ruptures from natural causes it is the left side of the heart, and particularly the left ventricle, in which a rupture is most frequently found. The symptoms are sudden pain, collapse, cramps, cold extremities, and rapid death. According to the circumstances in which they occur, cases of rupture from disease may create a suspicion of death from violence.

When the heart is ruptured accidentally from a blow or a fall it is not always accompanied by marks of external violence, or any fracture or other injury to the exterior of the chest

A girl was knocked down and run over by a cart. When brought to the hospital she was dead, and there was no mark of injury upon any part of the body. On inspection the pericardium was found to be full of blood, which had issued from a transverse rent across the apex of the heart. Both ventricles were laid open; the muscular substance was torn to a greater extent than the pericardium. The spine and ribs were unbroken, and there was no injury to any other organ. It was obvious that the injury to the heart had been occasioned by the accident.[2]

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[1] Gilchrist, R., *B.M.J.*, April 20th, 1929.

[2] *Med. Gaz.*, vol. 48, p. 1063.

A case is recorded in which a cart-wheel passed over the chest of a child and occasioned immediate death by causing rupture of the heart. Christison met with two similar instances, one caused by a fall, the other by a blow. A child was killed, as was supposed, by the wheel of a carriage going over its chest. On inspection the skin, muscles and ribs were free from any marks of injury. The pericardium was lacerated, and a pint of blood was effused into the right pleural cavity. The heart was found ruptured throughout its entire length. In another case, a man fell from a cliff the height of one hundred feet. There were a few slight bruises about the body, but no serious wound or fracture. On opening the chest the pericardium was found to be distended with dark fluid blood, which had escaped from an irregular opening about three-quarters of an inch in diameter, situated in the anterior portion of the right auricle. A boy was run over by a heavy waggon, two wheels of which passed over his chest. He arose apparently not much injured, put on reaching the side of the street fell dead. On dissection the heart was found uptured. The ribs were not fractured, nor was there any laceration of the walls of the chest.

The *natural* causes of rupture of the heart are violent mental emotions such as anger, fright, terror, paroxysms of passion, sudden or excessive muscular efforts, or violent physical exertions in constrained positions—in short, to conditions associated with increased blood pressure and extra strain on the cardiac muscle. Rupture of a *healthy* heart from any of these natural causes must be a rare occurrence, if indeed it is a physiological possibility at all.

Rupture of the heart may prove suddenly and rapidly fatal even although the lesion may not involve the cavities.

A lady, *æt.* 75, was suddenly seized with faintness and occasional fits of hurried respiration; she died in about an hour. On inspection the pericardium was found to be distended with twelve ounces of blood, one-third of which was in a coagulated state. A fissure was found in the superficial fibres about one-third of an inch in length, over the left ventricle and near the septum. There was another and smaller laceration a little higher up. The larger rent communicated with one of the coronary veins, and from this and some of the smaller arteries in the substance of the heart the hæmorrhage had proceeded. The lining membrane of the left ventricle was quite sound. Death had been caused by the mechanical effect of the blood in interrupting the heart's action.

When the heart is in a diseased condition, as in fatty degeneration, a slight cause of excitement or exertion is sufficient to produce rupture and sudden death.

Many cases of rupture of the heart from natural causes are reported in the medical press each year. In the greater number of these cases there has been exertion or other factor which might be expected to lead to increased blood pressure, and in addition degeneration of the cardiac muscle is usually observed. A certain number of cases, however, are published in which the symptoms of rupture have occurred during sleep. The following report[1] is typical of the latter class of case:—

An obese woman, aged 62, was a patient in a mental hospital, certified as a melancholic and later as a dement. On admission she was somewhat vaguely described as having "heart disease" and a "cardiac mitral murmur."

From 1895 until the day before her decease she worked in the laundry, with the exception of four years (1915 to 1919) during which she was employed in the kitchens. She enjoyed good health. On July 10th she had gone to the laundry as usual; she did not look well, but in reply to the laundress said she was all right. She ate a good dinner at midday, but in the afternoon complained of feeling "fagged," and sat down. She appeared to be much as usual when put to bed by the nurse at 8 p.m. in a dormitory which she shared with seven other mental patients, and which was visited every two hours by the night nurse. Nothing out of the ordinary was noticed at the 4 a.m. round ; but on visiting the ward again at 6 o'clock the nurse found the deceased out of bed on the floor in a semi-sitting posture, apparently dead, with head bent forward and face cyanosed. She died a minute or so later. Unfortunately the other patients were unable to give a reliable account of what had taken place, but it appeared that the deceased had been noticed about 5 a.m. rolling on the bed groaning, and evidently in some pain.

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[1] *B.M.J.*, August 30th, 1924.

On *post-mortem* examination the pericardial sac was found to be distended with blood clot surrounding the heart and slightly adherent. The heart was enlarged and fatty (19½ ounces). There was slight atheroma of the coronary arteries, and also of the bases of the mitral cusps. The left ventricle was enlarged, and on the inner surface of its anterior wall was a mass of organised blood clot closely adherent to the wall and extending to the interventricular septum. Opposite this mass on the external surface of the left ventricle was a small irregular perforation, but no apparent aneurysmal dilatation was present, although the ventricular wall appeared thinner here than elsewhere. Evidently there was leakage of blood for some time prior to death, and the gradual stretching of the pericardium was probably responsible for the pain experienced shortly before death. There was slight dilatation of the aortic arch, and early atheroma was present ; and there was also advanced atheroma of the circle of Willis. The kidneys weighed 5½ ounces each and were granular and fatty, but the capsules stripped fairly easily. The liver was large and congested, weighing 59½ ounces, and the lungs were emphysematous.

It is quite possible in such a case that partial rupture occurred as a result of exertion or violence, and that the tear became complete at a later period, possibly during sleep. In the following case,[1] however, it would appear that a partial rupture occurred during the night and became completed eight days afterwards.

A man, aged 70, complained that during the previous night he had been seized with severe pain in the epigastric region. At the time of examination the pain was practically gone, and nothing abnormal was detected. Eight days afterwards he had a heart attack and died in ten minutes.

Post-mortem Examination. The body was well nourished, with a tendency to obesity. The cerebral membranes were thickened and somewhat adherent to the surface of the brain ; the cerebral arteries were definitely thickened. On opening the chest the pericardium was seen to be well covered with fat. The pericardial sac, opened *in situ*, contained about 8 ounces of blood. The heart appeared of normal size. The valves were competent, but showed evidence of sclerosis. The cardiac musculature was flabby and apparently in a state of degeneration. Near the apex, and adjacent to the septum, on the internal surface of the anterior wall of the left ventricle, was a tear ¾ inch long. On attempting to pass a probe through this rent it came through only at the lower end to the external surface of the heart. The muscle immediately surrounding the rupture was necrotic. The coronary arteries were sclerosed and their lumen narrowed. On the inner surface of the aorta there were numerous atheromatous plaques. The kidneys were of average size, but their cortex was narrowed and contained two or three small cysts. Their capsules were somewhat adherent and their surfac showed only slight granulations.

Contusion of the heart may result from crushing injuries of the chest or from blows in cases in which there is no fracture of the ribs. Damage to the heart may be occasioned by the direct effect of the impact or by the suddenly increased intracardiac pressure caused by the blow.

The trauma may cause rupture, partial rupture, or contusion of the heart muscle leading to rapid death, to circulatory failure after a few hours, or death at a more remote period. Moritz considers that contusion does not lead to residual cardiac disability if the initial effect is recovered from, but this depends on the extent of the damage to the heart muscle.[1]

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[1] *B.M.J.*, April 18th, 1925.

DEATH FROM THE ENTRANCE OF AIR INTO WOUNDED VEINS

In wounds of *veins* there is an occasional and a peculiar cause of death which requires notice, namely, the entrance of air by the open mouth of the divided vessel.

Air gains access to the blood through a wound in a vein owing to the fact that during inspiration and certain phases of the heart's cycle there is a negative pressure in the veins.

WOUNDS AND RUPTURES OF THE DIAPHRAGM

The diaphragm, or muscular partition between the chest and abdomen, is liable to be wounded either by weapons which penetrate the cavity of the chest or abdomen, or by the ribs when fractured by violent blows or falls ; but, in any circumstances, wounds of this muscle are not likely to occur without implicating the important organs that are in contact with it. It is scarcely possible, therefore, to estimate the abstract danger of these injuries, which must materially depend on the concomitant mischief to the adjoining viscera.

Slight penetrating wounds of the diaphragm may heal, like those of other muscular parts ; many such cases are on record. There is, however, a consecutive source of mischief which no remedial means can avert—namely, the formation of a diaphragmatic hernia. The pressure of the abdominal viscera causes the scar in the diaphragm to yield, and they may then penetrate into the pleural cavity and be strangulated by the walls of the aperture. Such cases are not very common, nor are they extraordinarily rare.

In a case of this description, when death occurs at a long period after the infliction of the wound, the witness may be required to say whether the wound was the cause of death, or whether there were any other circumstances which would have caused or facilitated the production of a hernia. The degree of culpability of an aggressor may materially depend upon the answers returned to these questions ; as this form of internal rupture is not by any means an unusual or unexpected fatal consequence of a wound of the diaphragm, it would appear, at first sight, that death, at whatever period this event may occur, should be referred to the original wound. But the case may present some difficulties, as it is possible that a slight blow on the stomach received subsequently to the wound, or even any violent exertion on the part of the deceased, might have produced fatal strangulation. A person may survive with a large phrenic hernia for a considerable period, and die from some other cause. A case of this kind has already been related in which the stomach and part of the intestines were found in the left cavity of the chest, and the person lived for nine months. The fact of a person surviving will, however, depend on the freedom of communication between the chest and the abdomen. If the aperture is small and unyielding, strangulation may occur, followed by death within the usual period of time.

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[1] Moritz, A. R., Pathology of Trauma, p. 149. Philadelphia, 1942.

A case has been related elsewhere in which a man, who was stabbed in a quarrel, died from phrenic hernia fifteen months afterwards. This case is of importance, inasmuch as it shows that death may unexpectedly occur from the effects of an injury to the chest received a long time previously.

The most serious injuries to the diaphragm are unquestionably those which are produced by violent contusions or falls on the abdomen at a time when the stomach and intestines are distended. On these occasions the muscular fibres may be ruptured to a greater or less extent. The bleeding is not considerable, rarely exceeding two, three, or four ounces. A uniform result of such ruptures when extensive is a protrusion of the stomach into the chest, with occasional rupture of the coats of that organ and extravasation of its contents. Severe lacerations of the diaphragm are more readily produced during the act of inspiration than during expiration, the fibres of the muscle being then firmly contracted and receiving, while in this state of tension, the whole of the force. In a case of extensive rupture of the diaphragm related by Devergie, in which the stomach and colon were found in the chest, the person lived nine months after the only accident which could have produced it, and then died from another cause. Besides the stomach, it sometimes happens that the liver, spleen, or intestines pass through the opening, and these organs are then liable to become strangulated ; the lungs are at the same time so compressed that respiration is stopped, and asphyxia or suffocation may result.

Such immediate protrusions of viscera into the chest should not properly be called a diaphragmatic hernia. It is better to reserve that term for those cases in which the intrusion takes place more slowly.

WOUNDS OF THE WALLS OF THE ABDOMEN

Incised and punctured wounds, which affect the walls of the abdomen without penetrating the cavity, are not specially dangerous except on account of their proximity to the peritoneum and the dangers of extension of inflammation thereto.

But this statement, especially with regard to punctured wounds, is almost begging the whole question, which is, Has this wound penetrated, or has it not ? On the answer to it depends the whole course of treatment and the anxiety attendant on such wounds.

Improper medical treatment may, in either of these cases, lead to a fatal termination ; when a person stands charged with having inflicted such a wound it will be necessary for a medical witness to consider how far the consequences of the act have been aggravated by negligence or unskilfulness.

The walls of the abdomen are easily penetrated by pointed instruments, and it requires but a slight force to traverse them completely and wound the intestines. A slight wound may thus prove fatal by leading to peritoneal inflammation.

But when these wounds take a favourable course and heal, there is a possible after-effect, namely, a protrusion of the viscera at the scar, constituting **ventral hernia.** When the wound has involved the muscular fibres transversely to their course, the cicatrix which follows is commonly far less capable of resisting the pressure of the viscera within than other parts of the parietes. A hernia may take place, and this, like other herniæ if neglected, is liable to become strangulated and lead to death.

Penetrating wounds are not always fatal, even when such a result might be expected. A very large number of bullet wounds have apparently done no damage to viscera.

A soldier by accident so fell upon his bayonet that, although the weapon traversed the whole cavity of the abdomen (entering at the back and coming out in front below the navel), the man recovered in about six weeks. This case is of importance in reference to the situation and direction of wounds. Had there been no knowledge of the facts, this accidental wound might have been pronounced homicidal.

Cases like the following,[1] where a man lived for five months with a large arrow-head fixed in his abdomen after injury to important organs and recovered from the operation for its removal, must necessarily be infrequent.

The patient, a young Marwat Pathan, was admitted to hospital on October 27th, 1923, for abdominal pain. The history of the case was that, five months previously, he had been shot in the eighth right intercostal space in the anterior axillary line with a steel-headed arrow. At the time he grasped the shaft and extracted it, and was carried to his village, where he remained for about four weeks ill. After this time he got up and went about as usual, except for attacks of vague abdominal pain, which were aggravated by taking food. A month previous to admission he noticed a swelling, which had been tender, in the left epigastric region, and consulted the nearest Government dispensary, whence he was referred to hospital, a journey of some twenty-two miles by camel.

On admission a swelling about 1½ inches by 1 inch was seen in the left epigastric region, opposite the tip of the ninth left costal cartilage, and ¾ inch from the costal margin.

During the night of October 27th–28th, 1923, the patient "felt something move inside him," and next morning complained of a severe gnawing pain 1 inch below the left nipple.

An operation was performed, with the reddened swelling at its centre, and deepened at that point in order to localise any collection of pus that might exist. None, however, was found, the swelling consisting of partially organised granulation tissue, and the abdomen was opened along the length of the incision. On exploring with the hand the arrow-head could be felt high up in the left hypochondrium, pointing downwards, forwards, and to the right, moving markedly with respiration, and on retraction could be seen to be either intra-gastric or retro-gastric. The point of the arrow-head was seen firmly fixed in the posterior fibres of the diaphragm, and the lesser sac was obliterated round it, fairly firmly organised adhesions binding the stomach to the posterior abdominal wall.

The haft of the arrow-head (6½ inches long) was found in the fundus of the stomach, grasped with Mayo-Ochsner forceps, and pulled out, and the stomach cavity investigated. Hæmorrhage was fortunately negligible, and the anterior gastrotomy and the abdominal wound were closed.

Convalescence was uninterrupted and the patient left hospital cured, and on full diet, on the twenty-first day after operation.

The position of the entrance wound and the situation in which the weapon was discovered would seem definitely to establish the injury of the following structures: (1) the right pleural cavity, (2) the right dome of the diaphragm, (3) the liver, and (4) the stomach.

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[1] *Lancet*, February, 14th, 1925.

Contusions of the walls of the abdomen are attended generally with more serious effects than are those of the chest. This arises from the coverings of the abdomen having less power to resist external violence. Death may be the immediate result of a blow in the upper and central portions of the abdomen, even when no particular morbid changes are observed in the viscera or marks of violence on the skin. Death has been ascribed in these cases to shock from the effect of the violence on the nerve plexuses of the abdomen. Some remarks have already been made on sudden death from blows on this part of the abdomen (see p. 268). Cases of this kind are of not infrequent occurrence, and, in the absence of marks of physical injury in the part struck, a jury might be led to doubt whether the blow could have been the cause of death.

In *R.* v. *Jones* the prisoner was charged with having struck the deceased several blows on the breast and one on the pit of the stomach, upon which he immediately fell down senseless and expired. No morbid appearances were found. The prisoner was convicted of manslaughter. In another case death was thus caused by violence during a boxing match. A man received a blow in the stomach, and fell dead. As there were no marks of external injury, the surgeon thought the deceased had died of apoplexy. The prisoner was acquitted. In a similar case the deceased, a powerful man, received during a boxing match a blow on the abdomen, and he immediately fell backwards dead. On an examination of the body, there were no marks of injury, either externally or internally. The surgeon attributed death to sudden shock. The judge left it to the jury to say whether they thought the death of the deceased was caused by a blow; but if they could not say what was the cause of death, or if they should think that death was attributable to excitement, and that it was independent of the blow, the prisoner would be entitled to an acquittal. A verdict of not guilty was returned. Although the blow was seen to be struck, and was a sufficient cause of death in the circumstances, the jury probably thought that there should be some *visible* injury to the body.

It has been thought that these cases have not been accurately observed, and that in those which terminated fatally a more careful inspection would probably have revealed visible changes in the organic structures; many persons have died soon after having received a severe blow on the upper part of the abdomen, and medical men of experience who have examined the body have been unable to discover any physical injury, or any condition which could have caused sudden death.

A blow on the abdomen, when it does not cause death by shock, may cause death by setting up peritonitis, which may extend to other serous membranes (pleura and pericardium).

A man was convicted of manslaughter by giving to the deceased a kick in the lower part of the abdomen. No organ was ruptured, but peritonitis was set up, and death took place in two or three days. A soldier during an action was struck by a spent ball on the abdomen, over the region of the bladder. The ball fell on the ground at his feet without either injuring his clothes or even marking his skin. He did not feel much pain at the time, and walked to the hospital, a distance of two miles, with the ball in his pocket, but he died shortly afterwards from peritonitis and inflammation of the bladder. The entire surface of the abdomen presented the appearance of a severe bruise in a few hours after he was struck.

The following case seems even more difficult of explanation, and is so rare as to make it important that the case should be placed on permanent record in a work on legal medicine.

A little girl, seven years of age, went to school in her usual good health. On coming out of school, about midday, she came into contact with a drunken man in such a manner that she fell to the ground. It is uncertain whether she fell on her face and struck her abdomen on the kerbstone, or whether the man fell on her abdomen; but, however the accident happened, she at once complained of abdominal pain, and was carried home. The pain getting worse towards evening, a medical man was sent for, who sent her to the hospital on the following day. Rupture of the intestine was diagnosed, and the abdomen opened, but nothing except acute purulent peritonitis was found at the operation, and she speedily sank, and died two days later. At the *post-mortem* examination no external bruising, nor any in the muscles nor on the peritoneum, could be seen. The liver, kidneys, bladder, intestines and spleen were all most carefully examined from without and from within, and no trace of any tear, bruise, or wound could anywhere be found; the mucous membrane of the cæcum was a little darker in colour than usual, but nothing more than hypostases might account for, and certainly nothing like a submucous hæmorrhage was seen. There was acute purulent peritonitis, most marked over the dome of the liver; and this was obviously the cause of her death.

Between the blow and the pain, between the pain and the acute illness, between this and the discovery of acute purulent peritonitis, there was no quiescent interval, so that the chain of proof of cause and effect appears, on this ground, complete, and medical experience supplies no other explanation of the illness and death. It cannot be assumed that the peritonitis was present, in a latent form, before the accident, for no child could have gone to school in such a condition unless, possibly, with a small local chronic trouble of this nature, and there was not the slightest trace of evidence of any such condition.

Blows on the Abdomen are not always accompanied by a visible bruise or injury to the skin and, indeed, it must be remarked that when such bruising is found without injury to the skin it may possibly have been produced by violent muscular action, as in trying to escape a blow, and not by the blow itself. It is occasionally seen, too, as the result of disease—typhoid fever, for example—and might in such circumstances possibly give rise to suspicion of violence.

It is, after all, by the damage done to the underlying viscera that blows on and wounds of the abdomen have their dangers estimated, and it must again be emphasised that the most extensive internal damage may show no external bruising of the skin.

All the viscera are equally liable to be pierced or wounded by sharp penetrating weapons, dependent only on the situation and direction of the wound or weapon; but in blows by blunt weapons and in crushes the liver, spleen, and kidneys, owing to their compact structure, are most liable to rupture.

Laceration of the Liver. Rupture of the liver is most commonly the result of motor accidents and crushing accidents in industry. It may result from blows on the abdomen, by falls on the abdomen, or on the feet, and in rare instances by a sudden action of the abdominal muscles. An accident of this kind happened to a person who was endeavouring to avoid a fall from his horse. Ruptures of the liver are generally seen on the convex surface and anterior margin, seldom extending through the whole substance of the organ, but consisting of fissures, varying from one to two inches in depth. The right lobe, from its size, is more commonly affected than the left. The lacerated edges are not much separated, while the surfaces present a granular appearance. But little blood is met with in the laceration itself; it is commonly found effused in the lower part of the cavity of the peritoneum, or in the hollow of the pelvis, and is only in part coagulated. The bleeding, should the portal vein or vena cava be implicated, is sufficient to cause rapid death; but in other circumstances a person may survive some hours, as the blood may escape only slowly, or it may be suddenly effused in fatal quantity after some hours or days as a result of violent exertion or of fresh violence applied to the abdomen.

There went to hospital a man who presented no immediate or urgent symptoms. He was sent away, and a few hours afterwards was found dead in a cell at a police-station. On inspection the liver was lacerated, and a basinful of blood was found in the cavity of the abdomen. This effusion must have taken place after the man had left the hospital. A man, who had been in good health half an hour before, was found dead upon the high-road, and there was reason to believe that he had been run over by his own dray. The abdomen was found full of effused blood, which had proceeded from a large rupture on the under-surface of the right lobe of the liver. It was T-shaped, five inches in the transverse, and about two inches in the longitudinal direction. The diaphragm was ruptured on the right side for about four inches from before backwards, and the liver protruded through into the chest. On opening the head about two tablespoonfuls of blood were found effused between the membranes; and the substance of the brain was unhealthy. There were no marks of external violence. There was not the slightest scratch, abrasion, or discoloration of the skin; but the sixth and seventh ribs were broken transversely near their anterior extremities. From the state of the brain it was thought probable that the man had had an apoplectic seizure and had fallen under the wheel of the dray.

Ruptures of the liver, if fatal, generally cause death within forty-eight hours, but a case occurred in which a patient in Guy's Hospital survived this accident ten days. On inspection it was found that the diaphragm had been ruptured as well as the liver, and that the two had united, an abscess having been formed between them. The liver had been lacerated on its right side.

In another case in which the patient survived ten days, death took place from internal hæmorrhage. On inspection there was a rupture of the right border, involving the entire thickness of the liver. It arose from a fall from a third-storey window. There were no external marks of injury. Another case proved fatal in twenty-four hours.

In a case in which the liver was found adhering to the floating ribs, a fatal rupture was caused as a result of violent muscular action. The liver was large, and its substance brittle.

Ruptures of this organ may take place from violence applied to the *chest*, and there may be no marks of injury in the region of the liver. In *R.* v. *Cuffery* the question was raised in reference to these ruptures as to the time required for the effusion of a large quantity of blood into the abdomen when none of the large vessels is involved in the laceration.

A police-constable was charged with having caused the death of a man. The deceased was drunk, had fallen three times, and had been kicked and maltreated by a mob. The accused took or dragged him to the station, and in an attempt to escape he knocked down the deceased and fell on him, his knee striking the abdomen. The deceased appeared to suffer great pain when he was lifted up, but he was able to walk to the station with assistance; when there he soon became insensible, breathed heavily, and died fifteen or twenty minutes afterwards. On inspection the liver was found to be ruptured in three places, but none of the large blood vessels was involved. Upwards of three pints of blood were effused in the abdomen, and the medical witnesses agreed that death was due to internal hæmorrhage as a result of the ruptures. The question, however, arose whether the ruptures were caused by the violence of the prisoner about twenty minutes before death, or by any of the falls and ill-treatment which had occurred previously.

For the defence it was suggested that so large a quantity of blood could not be effused in so short a period as a quarter of an hour or twenty minutes, inasmuch as the rupture involved only the substance of the liver, and not the large blood vessels. Hence it was alleged that the rupture must have been caused by the previous violence. One medical witness thought it possible that this quantity of blood might have escaped from the smaller vessels within the time mentioned; another thought that it would have taken at least half an hour for such an extensive effusion to be produced. The accused was acquitted.

The question here raised was based on speculation, and it is not surprising that the witnesses differed. The violence received before the accused took the deceased into custody was admitted to have been quite sufficient to account for the ruptures of the liver and the fatal hæmorrhage, and there was nothing to fix it on the act of the prisoner. We have no means of measuring the rapidity with which blood flows on these occasions. It is stated that the liver was ruptured in three places; hence an extensive bleeding surface must have been exposed. The man was able to walk after the violence; and this exertion may have added to the hæmorrhage. Some bleeding would probably continue after death so long as the blood retained its warmth and fluidity. The accused was acquitted, not because the amount of effusion was inconsistent with the time assigned, but because the evidence did not prove that his violence caused the rupture. Assuming that the rupture existed when the deceased was struck by the accused, it might have been a question whether his violence had accelerated death by increasing the hæmorrhage.

Certain pathological states of the liver render it more friable and therefore liable to be ruptured with minor degrees of violence, for example in fatty degeneration, malaria, etc.

Wounds of the Gall-bladder. Wounds and ruptures of the gall-bladder are necessarily attended with the effusion of bile. This fluid finds its way into the cavity of the abdomen, and the person may die from peritonitis. In a fatal case of this description, an old man, while getting out of bed, fell with great violence on the floor. He died from peritonitis in forty-eight hours. The gall-bladder was ruptured, and a large stone was found impacted in the cystic duct.

Ruptures of the Spleen. Ruptures of the spleen may occur either from violence or disease, and it would appear from the following case that a slight degree of violence is sufficient to rupture this organ, while there may be no marks of injury externally.

A middle-aged man was observed fighting with a boy about fourteen years of age, who in stature scarcely reached to his waist. When the fight had terminated the boy ran away; the deceased was observed to become weak and faint, and he complained of uneasiness in his left side. He expired a few minutes afterwards. On inspection no marks of violence could be detected externally; but the cavity of the abdomen contained a large quantity of blood. The spleen was found enlarged, and so softened that its structure was broken down by the slightest pressure. There was a laceration across its surface, about half an inch in depth from which the fatal bleeding had proceeded. In a similar case death occurred in fifteen minutes. The rupture was caused by a blow, but there was no mark externally to indicate that a blow had been struck.

A little girl died in fourteen hours from rupture of the spleen. The rupture had been caused by the wheel of a cart passing over her body. There was no mark of external violence. It is highly probable that, when the spleen is ruptured from slight causes, the structure of the organ will be found to be in a diseased condition—a circumstance which might in some cases be regarded as mitigatory of the act of an assailant.

A man, *æt.* 24, fell from a masthead, twenty-five feet in height, and it was thought that he had fallen on his back. He was rowed ashore, and walked to the hospital, where he arrived about an hour after the accident. He died in a quarter of an hour, apparently from internal hæmorrhage. On inspection there were no external signs of injury. The abdomen contained several pints of blood. The spleen was torn transversely through its middle, and the splenic vein was lacerated in a longitudinal direction. This organ was about twice its natural size, soft, and had the appearance of a malarial spleen. The exertion of walking probably led to the fatal effusion, and accelerated death.

Cases of spontaneous rupture of the spleen are reported from time to time,[1] but it is extremely doubtful if a normal spleen ever ruptures spontaneously. When the spleen is the seat of disease as, for example, in malaria particularly, but also in Banti's disease, in Kala Azar, in leukaemia, etc., it is liable to rupture with comparatively little violence. It is also liable to rupture in localised pathological conditions of the organ. Ruptures vary enormously, they may be superficial or deep, single or multiple. In some cases the trauma may not lead to rupture of the capsule and consequently a hæmatoma develops in the organ which may rupture the capsule and produce serious symptoms only after several days. In one recorded case no complaint was made for 36 hours after the injury.[2]

Death from rupture of the spleen is usually rapid, but occasionally it is delayed,[3] and recovery may apparently occur without operation. Lieutenant-Colonel E. G. Russell, I.M.S., in his work on "Injuries of the Spleen," gives two cases in which recovery apparently took place after rupture or bruise of the spleen, the diagnosis in one case being confirmed by dissection of the victim, who died several years afterwards. He also quotes four cases in which the victim survived the injury for over twenty-four hours, in one case five, in two four, and in one two and a half days. (See also Medical Jurisprudence in India, Vol. II.)

RUPTURES OF THE KIDNEYS

The *kidneys* are occasionally ruptured from violence. This appears to be a rare accident without considerable violence; but many cases of it will be found in the medical press.

As a rule there is evidence of direct injury over the region of the kidney, caused by the passage of a motor wheel, a kick, or a blow. The blow may cause contusions or lacerations of the tissue of the kidney, the capsule, the perinephric tissues, the pelvis or the pedicle.

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[1] Susman, M. P., *Brit. Jour. Surg.*, 15 : 47, 1927.
[2] Smith, S., *R.A.M.C. Journal*, 46 : 269 (1926).
[3] Steenrod, E. J., *Amer. Jour. Surg.*, 49 : 129, 1940.

A rupture of the kidney may be produced without any prominent symptoms and cause death in a few hours.

A man, *æt.* 60, was run over by a light cart. He walked to the house of a friend at a short distance and went with him to the hospital in a cab. It was found that three ribs were fractured, but there was no urgent symptom or sign of collapse. He was treated for fractured ribs, and then walked home with his friend and went to bed. Between five and six hours after the accident he was observed to sit up in bed and suddenly fall back dead. On inspection no bruise or wound of any kind was found on the injured side. There was a large quantity of fluid and coagulated blood in the abdomen. This had evidently proceeded from the right kidney, which was torn in half transversely, through the pelvis. The ninth, tenth, and eleventh ribs were fractured. It is probable that the blood had escaped slowly from the ruptured organ.

Contusions of the kidney in themselves may not cause serious symptoms, and spontaneous healing of these injuries sometimes occurs.[1] In most cases, however, bruising of the kidneys is likely to be only one injury amongst other extensive injuries.

Kidney damage appears to be a feature of crushing injuries or in cases of compression [2] [3] in which no crushing of the tissues can be observed, for example, in persons pinned under fallen masonry in bombed houses. Oedema and anuria accompanies the shock in these cases, and if death occurs the kidneys are found swollen and pale, with marked degeneration of the cells lining the tubules and with masses of debris in the tubules.

WOUNDS AND RUPTURES OF THE INTESTINES

Rupture of the intestines sometimes occurs from disease, and in a case of rupture alleged to have been produced by violence we must always take this into account. The ruptured part of the bowel should be carefully examined in order to see whether there are any signs of ulceration or new growth. If not, and if there is clear evidence of violence having been used, it is impossible to admit this speculative objection. If with the proof of violence there should also be a diseased condition of the bowel we may be required to say whether this did not create a greater liability to rupture, a point which must be admitted. The intestines may be ruptured by an accidental fall. Rupture of the intestines may occasionally occur from very slight causes. Any force, as a slight blow *suddenly* applied to the abdomen, will sometimes suffice to cause it

A case has been related where the blow of a pebble ruptured the jejunum of a young girl by striking the abdomen. A case is reported in which there was no doubt that the ileum had been ruptured by a kick on the abdomen, leading to death by peritonitis.

It is worthy of remark that rupture of the intestines does not necessarily deprive a person of the power of locomotion.

A boy, *æt.* 13, had his duodenum completely ruptured across by a blow; he walked a mile with but little assistance, but he died in thirteen hours. A boy of 13 was struck by a cricket-ball in the right groin, in spite of which injury he remained on the ground more than an hour and a half and then walked more than a mile to his home. He died on the fifth day from peritonitis as a result of rupture of the intestines and escape of the contents.

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[1] Harrison, J. H., *Surg. Gynæcol. and Obstet.*, 70 : 93, 1940.

[2] Beall, D. and others, *B.M.J.*, 1 : 432, 1941.

[3] Mayon White, R., and Solonat, O. M., *B.M.J.*, 1 : 434, 1941.

A man brought into Guy's Hospital was able to walk to his bed, and he did not appear to be seriously injured, although it was stated that a bale of wool had fallen on him. In the evening he became collapsed, and died twelve hours after admission. Nearly a pint of blood was effused in the abdomen, and a portion of the ileum was found lacerated, the laceration extending into the mesentery and including the blood vessels. The laceration was about an inch and a half long, and the bowel was divided not quite through. The intestines were much matted together by lymph and blood, the result of peritoneal inflammation. There had been only slight extravasation of the contents. In two fatal cases of ruptured jejunum, one arising from a kick on the abdomen and the other from an accidental fall, it was observed that the power of locomotion and muscular exertion was retained.

Rupture of the intestines is commonly due to traffic accidents, to crushing injuries, and to falls from a height. The jejunum is probably the commonest site, followed by the ilium, duodenum, and large intestine.[1] The damage varies with the nature of the violence, and one may find complete section of the bowel in severe crushing injuries where the bowel is nipped between the vertebræ and the applied force, a series of semi-circular splits in less violent injuries, bursting effects, surface contusions or simple tearing of the mesentery. Death may be due to shock, hæmorrhage, infarction or peritonitis. In many cases of abdominal violence paralysis of the bowel (ileus) may occur and lead to death, even when no particular lesions can be found. In blast injuries from high explosives, hæmorrhage and lacerations of the bowel are frequently found.

That rupture of the intestines is not incompatible with the power of locomotion is also proved by a case where the cæcum was ruptured; the man was able to walk after the accident, but he died in twenty-four hours.

Punctured wounds consist chiefly of stab wounds and bullet wounds. Occasionally perforation of the abdominal cavity occurs without damage to its contents, but usually the gut is wounded in a number of places. Death may be due to hæmorrhage, shock, or peritonitis.

A peculiar type of rupture of the gut due to practical joking with compressed air has lately become rather common. Andrews in 1911[2] quoted sixteen cases of this kind of traumatism. Andrews has shown that it requires a pressure of only seven to twelve and a half pounds to rupture the gut. In many of the cases the nozzle of the compressed air pipe was some inches away from the anus, and the victims were fully dressed. Rupture of the large bowel is likely to take place, and the inflation of the gut causes rapid unconsciousness in some instances. In twenty-seven cases collected by Block[3] the mortality was 70 per cent.

WOUNDS AND RUPTURES OF THE STOMACH

Perforating wounds of the stomach may be due to stabs or gunshot wounds. Non-perforating injuries may be caused by blows or crushes.

In crushing injuries the stomach is much less likely to be injured than the small intestine owing to its less exposed position, but it may be damaged by any of the forms of violence described under intestinal injuries, and as in these viscera, contusion or rupture may occur without leaving any trace of violence on the surface of the body. If the stomach is empty at the time of the violence it has little chance of rupture. If it is full severe pressure may rupture all coats of the organ, or, more commonly, the mucous and submucous layers only. In these latter injuries symptoms may be delayed for several hours. Complete rupture may occur subsequently with the onset of severe symptoms and danger to life. If complete rupture does not occur, an ulcer may form at the site of the injury. Cases have been reported of rupture of the stomach in which there was no history of violence and no evident pathological condition of the organ.

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[1] Counsellor, V. S., and McCormack, C. J., *Ann. Surgery.* 102 : 365. 1935.

[2] *Jour. Surg. Gynæc. and Obstet.*, January, 1911

[3] *Jour. Amer. Med. Ass.*, May 22nd, 1926.

A man, *æt.* 34, was brought into hospital complaining of severe pain in the abdomen. Ten hours afterwards he was seized with violent vomiting ; the pain and the vomiting ceased, and he died in five hours. The posterior surface of the stomach was found lacerated to the extent of three inches, and its contents had escaped through the aperture ; the mucous membrane was reddened, but there was no thickening, ulceration, or any apparent disease. A man, *æt.* 30, suffering from intermittent fever, died suddenly after having been to the water-closet. On inspection the stomach was found ruptured on its anterior surface to the extent of about two inches, and the contents had escaped into the abdomen. There was no softening or morbid change in the coats, with the exception that the mucous membrane was dotted with redness for a slight distance around the aperture.

Such an injury is not inconsistent with the power of locomotion, although it may be doubted whether in the case reported the large rent in the stomach took place until just before death. It is obvious that in alleged lacerations from violence this liability to spontaneous rupture must not be forgotten.

RUPTURES OF THE BLADDER

This injury may occur as a complication in fracture of the pelvis ; as the result of a fall, a kick, or blow on the abdomen when the bladder is distended, from perforating wounds, or spontaneously from pathological causes. The rupture may be intra peritoneal or extra peritoneal ; in the former case the urine passes into the peritoneal cavity, in the latter it passes between the peritoneum and the abdominal wall.

Rupture from a kick or a blow is due to pressure on the contained urine and as this pressure is exerted uniformly over the whole surface the bladder ruptures at its weakest point, usually over its upper and back surface, especially if it is full. In cases in which it is not full a severe kick may cause a rupture towards its lower pole.

Rupture is much less common in females owing to their relatively simple urethra. It is most common in cases of drunkenness owing to the liability to distention of the bladder.

In all cases of rupture of the bladder there is a definite risk to life. The usual period at which death occurs is in from three to seven days ; but in one case the person did not die until the fifteenth day. The cause of death is usually peritonitis ; but a person may die suddenly as a result of shock.

A man, while struggling with another, received a severe kick on the lower part of the abdomen. He fell backwards, and died immediately. On inspection the brain was congested, but otherwise healthy ; the heart was free from disease, but much distended with black coagulated blood. The bladder presented, on the left side of the body, a rent of about two inches ; but this organ was in other respects healthy, as well as the urethra. There was some bloody effusion in the cellular tissue. The peritoneum and viscera of the abdomen were uninjured. There were no marks of violence on the body.

When such ruptures are produced by blows, they are rarely accompanied by marks of ecchymosis, or of injury to the skin. Thus, then, there may be no means of distinguishing, by external examination, whether a rupture was really due to violence or to spontaneous causes.

During a quarrel one man struck another a severe blow on the lower part of the abdomen. The latter was carried home, confined to his bed, and died in seven days. There were only a few superficial excoriations on the skin of the abdomen. The bladder was found ruptured to the extent of two inches in its upper and back part ; it was highly inflamed. Throughout the abdomen there were the marks of general peritonitis, of which the man had died.

Some doubt was thrown on the correctness of the medical opinion that the rupture had been caused by a blow, because there was no ecchymosis or other mark indicative of a severe blow over the region of the bladder. The witnesses properly answered that ruptures of the viscera of the abdomen from violence were not necessarily attended with the marks of violence found in injuries to other parts, owing to the yielding and elastic nature of the parietes. One of them mentioned a case that had occurred in his practice where a soldier had received in the abdomen a kick from a horse, which had ruptured the small intestines, and caused death ; but there was not the slightest trace of violence externally.

In another case, the accused, who was half intoxicated, met the deceased on the high-road, and without receiving any provocation gave him a violent kick on the lower part of his abdomen. The deceased turned sick ; he attempted to pass his urine, but could not ; he was conveyed home, and died from peritonitis in five days. There was no ecchymosis, or other injury to the skin indicative of external violence ; but the bladder was found ruptured, and the contents extravasated. The rupture was attributed to the blow inflicted by the accused.

For the defence, it was contended that, as there was no mark of a blow, the rupture might have occurred spontaneously from simple overdistension. The judge observed that, if the rupture were thus occasioned, it was remarkable that it should have happened immediately after a violent blow had been struck on the part. The distension of the organ might, however, have rendered the blow *more dangerous* than it otherwise would have been. The accused was convicted.

As an attempt may be made, in cases in which death has resulted from this injury, to refer rupture of this organ to natural causes, it may be observed that this is an unusual occurrence. The normal bladder can withstand enormous distension without rupture. I once saw a boy who had tied a piece of string round his penis and who died from urinary retention and pressure. His bladder filled practically the whole of the abdomen and was stretched as thin as paper without rupturing. A rupture is almost always the result of violence applied while the organ is in a *distended* state. A *spontaneous rupture* may, however, occur : (1) when there is " distension with overflow " from disease ; (2) when the bladder is ulcerated, or otherwise diseased ; (3) when there is an obstruction in the urethra from stricture or other causes. (4) Cases are recorded in which no cause whatever could be found. The causes of spontaneous rupture are recognisable by ascertaining the previous condition of the deceased or examining the bladder and urethra after death. If a man were in good health prior to being struck; if he suddenly felt intense pain, could not pass his urine afterwards, and died from an attack of peritonitis in five or six days; if after death the bladder were found lacerated, but this organ and the urethra were otherwise in a healthy condition, there can be no doubt that the blow must have been the sole cause of rupture and death. A diseased state of the bladder would probably diminish the responsibility of an accused person for the consequences; therefore the state of this organ should be closely observed on these occasions. This most serious injury is never liable to result from violence, except when the bladder is distended. If a pregnant woman were killed by a blow on the abdomen, which caused rupture of the uterus, the act could not be regarded as admitting of mitigation because the uterus is only occasionally in this distended state.

Rupture of the bladder is liable to occur in women during parturition, owing to the pressure of the child's head, an occurrence which may result in a charge of malpraxis against the medical attendant. It may also occur by perforation from the vagina in cases of abortion, from perforation from within by a cystoscope, catheter or other body introduced through the urethra.

In punctured, incised and gunshot wounds of the bladder there are usually serious injury to other viscera, but the dangers from extravasation of urine, shock and septic infection are similar to rupture from other causes.

WOUNDS OF THE GENITAL ORGANS

Wounds of the sexual organs may be self-inflicted in cases of insanity, or they may be inflicted from motives of revenge. They are occasionally inflicted for the purpose of sexual gratification. They may be produced by kicks, falls or blows. Although injuries of the private parts are likely to produce shock and free hæmorrhage they are by no means uniformly fatal. Many cases of amputation of the penis and testicles have recovered and Littlejohn[1] describes a case in which a deserted female enticed her paramour to get into bed with her and when he was about to have sexual connection she seized his penis and cut it off with a table knife. The man recovered and was afterwards the father of several children. Similarly the amputation of the penis and testes of young negroes to convert them into eunuchs, though proving at times fatal, is commonly successful.

Incised, lacerated, or even contused wounds of the female genitals may prove fatal by loss of blood, not from the wound involving any large vessel, but from the numerous small vessels which are divided, as there is a good deal of erectile and very vascular tissue in the neighbourhood. Two women were in this way murdered in Edinburgh many years ago. The wounds were inflicted by razors, and the women bled to death.

A practitioner may be sometimes required to determine whether wounds affecting the female organs have resulted from accident, have been self-inflicted, or inflicted by others with homicidal or sexual intention.

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[1] *Forensic Med.* (J. & A. Churchill), p. 214.

A woman received a longitudinal wound in the genitals on the left side by a cutting instrument to the extent of an inch and a half. There was a smaller wound on the right side. The accused alleged that the woman had inflicted the injury on herself; and Easton, on being required to state his opinion on the question at issue, came to the conclusion—(1) from the regular edges of the wounds, that they had been produced by a clean-cutting instrument, and therefore could not have been caused by a fall, excepting the person had fallen upon some sharply cutting projection; (2) if the woman had injured herself by thrusting a knife into the private parts, the situation and direction of the wounds would have been different. There was a want of proof to connect the accused with the act, and he was discharged.

This matter has already been discussed in general, and here it is necessary only to draw attention to the fact that, owing to the proximity of the pubic bones, these parts behave under violence in a manner very similar to that in which the scalp behaves; that is to say, blunt violence may produce an apparently incised wound. Hence wounds of this region require very careful and minute examination to determine the method of infliction.

Similarly we have discussed accident, suicide, or homicide in general terms for all wounds.

We may say, as regards suicide, that if the patient is insane and especially if the form of insanity has any leaning towards sexual ideas, then wounds in this situation may be regarded as a likely attempt at suicide. If, on the other hand, there is no question of insanity, then a wound in this region is almost certainly accidental or homicidal.

Accidental wounds of the genitals, unless all the circumstances are known, may sometimes resemble those produced by design.

A girl, *æt.* 6, fell from a tree with her legs apart upon one of the sharp-pointed shoots less than half an inch thick. This entered the vagina, and passing through its posterior wall, broke off. The wood was removed with some difficulty and the child died in twenty-eight hours from peritonitis. If, later, the child had been found dead with the wood in her body, there might have been some difficulty in assigning an accidental origin to the injury.

A case is reported in which a woman, in the eighth month of pregnancy, fell from a chair, which also fell with her. There was hæmorrhage, and she died in a quarter of an hour. The blood had flowed from a wound an inch and a half long, situated between the right labium and the urethra. The edges appeared to be cleanly divided, and the wound penetrated into the cellular tissue.

Again, homicidal wounds are by no means rare, as the parts offer to a brutal or drunken man a point of attack to which his mind instinctively turns. Of this the following is a very good illustration, though, except in its fatal results, it is a very common incident:—

A woman, *æt.* 36, received a kick from her husband in the lower part of the abdomen, while she was in a stooping posture. When seen in about three-quarters of an hour, she had lost from three to four pounds of blood. She was sinking, and expired a few minutes afterwards. On inspection there was no injury to the uterus or vagina; the wound was situated at the edge of the vulva, extending from the pubes along the ramus of that bone. It was about an inch long and three quarters of an inch deep. The left crus clitoridis was crushed throughout its length, so as to exhibit its cavernous structure. From this the fatal bleeding had proceeded. The heart and great vessels contained no blood.

When a woman is pregnant the bleeding from such injuries is always likely to be more profuse, but is not always fatal.

The following case[1] illustrates the extreme injuries which may occasionally be inflicted without causing death :

A woman, three months pregnant, while going downstairs, tripped on one end of a loose stair-rod, which was sharp-pointed. She fell, and the rod, coming up like a tip-cat, entered her perineum. On admission to hospital three inches of the stair-rod were seen protruding from the left side of the perineum.

On opening the abdomen it was found that the rod had traversed the vagina and transfixed the right broad ligament, passing beside the pregnant uterus. It crossed the pelvis without injuring the gut, pierced the external iliac vein, and entered the psoas muscle. Running upwards in the muscle, it was next seen crossing the interval between the duodenum and the liver, and disappearing into this latter organ.

The rod was removed gradually by traction on its lower end. The rod was 2 feet 6 inches long, and it was evident that the point must have reached the level of the manubrium sterni, after piercing the diaphragm and the lung.

Convalescence was uninterrupted, except for the coughing up on one occasion of an ounce or two of pus, presumably from a lung abscess, and the pregnancy was continued, the patient being discharged fit and well. Unfortunately, however, labour at full term was complicated by intestinal obstruction from adhesion of a loop of gut to the laparotomy scar, and death took place.

When *incised* wounds are inflicted upon the genital organs of either sex, the fact of their existence in such a situation is strongly presumptive of malice on the part of an assailant, or of deliberate suicide or self mutilation.

In *R.* v. *Ling*, the medical evidence for the prosecution showed that a wound in the vulva of a female, found dead from hæmorrhage, had been produced by a stick on which blood and hair were found. A medical man who appeared for the defence thought that a varicose vein had burst and caused the bleeding, and that the injury had not been produced by the violent use of a stick. The prisoner was acquitted.

It is difficult to see how a puncture wound from a stick (which must have a comparatively blunt point) could be mistaken for the small wound made by the rupture of a varicose vein.

FRACTURES

Fractures of the bones have some important bearings in relation to medical jurisprudence. They may result from falls, blows, or the spontaneous action of the muscles.

Questions often arise as to whether a particular fracture was caused by an accidental fall or a blow, and if by a blow, whether by the use of a weapon or not. It is obvious that the answers must depend upon the circumstances of each case. In examining a fracture it is important to determine, if possible, whether a *weapon* has or has not been used, and this may be sometimes ascertained by the state of the parts. It is a common defence on these occasions to attribute the fracture to an accidental fall. Fractures occur more readily in old persons than in the young, and in young persons rather than in adults, because at the adult period of life the bones possess their maximum degree of firmness and solidity. The bones of aged persons are sometimes very *brittle*, and they may become unduly brittle in chronic nutritional disorders, in certain endocrine disturbances, in wasting diseases, in syphilis, arthritis, cancer, scurvy, and rickets and sometimes in apparently healthy persons.

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[1] Steel, G. H., *B.M.J.* 1 983 (1932).

This *fragilitas ossium* has already been considered (*vide ante*, p. 295). In criminal cases the defence might rely upon an abnormal condition of the bones, where the violence causing the fracture was slight. Several trials have taken place in which brittleness of the bones became a subject of inquiry. In a case of fractured skull leading to death from inflammation of the brain, it was proved that the bones of the skull were exceptionally thin and brittle, and this led to a mitigation of punishment.

Spontaneous Fractures. In a case in which there is no appearance of disease, a fracture may be ascribed to spontaneous causes. Thus, bones have been fractured by moderate muscular exertion. Modern surgery can supply examples from almost every region in the body.

The elbow (olecranon), heel-bone (os calcis), knee-cap (patella), and femur in old people are particularly exposed to this accident. The other long bones are not so frequently the subject of an accident of this kind; but the arm (humerus) in a healthy man has been broken by the simple muscular exertion of throwing a cricket-ball.

A young lady fractured the neck of the scapula by suddenly throwing a necklace round her neck. A man, *æt.* 40, was in the act of bowling at cricket, when on delivering the ball he and some spectators heard distinctly a sharp crack, like the breaking of a dry piece of wood. He fell to the ground as if he had been shot. The thigh-bone was found to be fractured, evidently from muscular exertion only. While a strong young Scotsman was in the act of "putting" a sixteen-pound shot, making at the time a violent effort, he felt something snap in his arm and instantly lost all power over it. It was found, on examination, that the humerus had been broken by muscular force. Spontaneous fracture of the femur occurred to a healthy temperate man, *æt.* 33, who was in the act of placing one leg over the other to look at the sole of his foot, when he heard something give way, and the right leg immediately hung down. The right thigh-bone had been transversely fractured at the junction of its middle with the lower third.

In fractures arising from this cause there will be no abrasion of the skin, nor any appearance to indicate that a blow has been struck; while the marks of a blow would be incompatable with fracture from muscular action. It is unusual that the ribs should be fractured from muscular exertion; but a case occurred which shows that this accident is possible.

A strong healthy labourer, *æt.* 45, slipped while walking and saved his footing only by the exertion of considerable strength. While recovering his balance he felt a sharp pain on his right side, which was aggravated by inspiration and by exertion, so that he reached home with difficulty. On examination, a tender area of about half a hand's breadth was found in the axillary region over the seventh and eighth ribs. Crepitation was not distinct, and emphysema was not present. As the pain occurred so suddenly and was limited to so small a space, it was supposed that a rupture of the muscular fibres had taken place, although the absence of all swelling and effusion, as well as of any depression amidst the fibres, rendered this not very probable. Pleurisy was set up, and the patient was confined to bed for a fortnight; when all traces of pain had left the part, the deposition of callus (new bone) plainly showed that there had been fractures of the seventh and eighth ribs.

Such cases are easily discovered by X-ray examination.

Fractures are not ordinarily *dangerous to life*, though death may occur from shock, hæmorrhage, septic infection, fat, blood, or air embolism,

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[1] *Dubin Quart. Jour.*, 1870.

or the confinement may cause hypostatic pneumonia. Healing may not take place and a false joint may be formed ; it may take place in bad alignment or fusion of two bones may occur leading to loss of function, or the fracture may set up secondary effects in adjacent joints. They must therefore be considered serious injuries.

Fractures in the Living and Dead Body. It is not always easy to say whether a fracture has been produced *before or after death*. A fracture produced shortly after death, while the body is warm, and another produced shortly before death, will present similar characters to the naked eye, except that in the latter case there will be more blood effused, the blood will be more firmly clotted and will penetrate into the adjacent tissues. A fracture caused ten or twelve hours before death would be indicated by a copious effusion of blood into the surrounding parts and between the fractured edges of the bones, as well as by laceration of the muscles ; or if for a longer period before death, there may be the marks of inflammation. Fractures caused several hours after death are not accompanied by an effusion of blood. A medical witness may be asked how long the deceased survived after receiving the fracture. This is a question which can be decided only by a complete histological and radiological examination of the fractured part. In the first few hours a hæmatoma is formed around and about the broken ends of the bone. Lymph is effused, causing increasing swelling of the tissues, the blood clots, the damaged area becomes infiltrated with cells, blood vessels are formed and gradually a firm tissue or callus forms a scaffolding round the fractured ends. This callus is in course of time transformed into bone. Most text books of pathology give a time table of these events from the first few hours until union occurs, but it is extremely difficult to give an opinion with any considerable degree of precision. We can say whether a person lived for a long or a short time after receiving a fracture, but to specify the exact time is clearly impossible, since this process of restoration in bone varies according to age, constitution, and many other circumstances, such as the site of the fracture, the degree of apposition of the ends, the possibility of immobilisation, etc. In young persons bones unite rapidly, in the old slowly ; in the diseased and unhealthy the process of union is slow, and sometimes does not take place at all. It requires a period of several months for the callus to acquire all the hardness, firmness, and power of resisting shocks possessed by the original bone. Though there may be quite firm union in a long bone in a matter of four to six weeks it is doubtful if bony reconstruction is completed under about six months. Occasionally healing is greatly accelerated, occasionally it is greatly retarded, and sometimes it may not occur at all.

X-ray examination enables the medical observer not only to establish the absence or presence of a fracture but to obtain an idea of its age and sometimes information about the method of its infliction.

Has a Bone ever been Fractured ? This question is sometimes put in reference to the *living* body. It is well known that a bone seldom unites so evenly that the point of bony union is not indicated by a node or projection. Some bones are so exposed as to be well placed for this examination, as the radius, the collar-bone, and tibia ; in others the detection is difficult by palpation, but X-ray examination will usually enable the observer to localise the healed fracture. If healing is complete

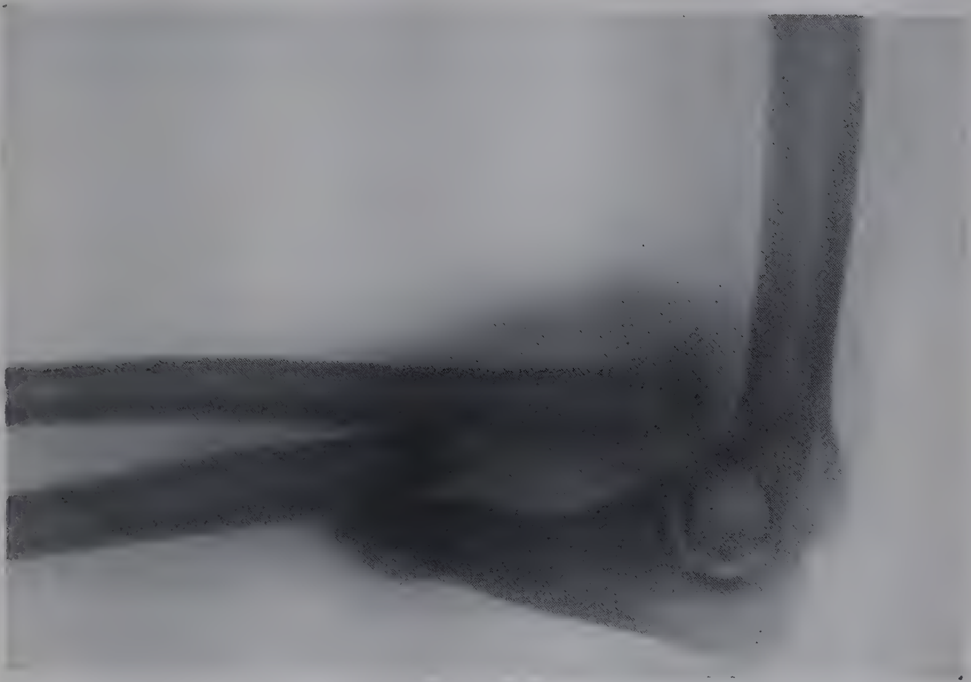

Fig. 24.—Fracture of the ulnar bone, with forward dislocation of the head of the radius due to a blow on the back of the arm from a heavy stick. Injury Aug. 14th. Photograph Dec. 9th. About four months' duration.

To face page 390.

it is impossible to say when the fracture took place ; it may have been six months or six years before, as after the former period the bone undergoes no perceptible change. These facts are of importance in relation to the *dead* as well as to the living, since they will enable us to answer questions respecting the identity of skeletons found under suspicious circumstances, and here medical evidence may take a wider range, for a fracture in any bone may be discovered, if not by external examination, at least by sawing the bone longitudinally through the suspected broken part when, should the suspicion be correct, the bony shell will be found thicker and less regular in the situation of the united fracture than in the other parts. In such cases it may be easy to say whether a fracture is recent or of old standing.

With respect to the power of *locomotion* after a fracture, it may be observed that when the injury is in the arm or in the ribs—unless many of them are broken or the fractures are on both sides—a person may be able to move about, although unfitted for struggling or making great exertion. Fractures of the leg generally incapacitate persons from moving, but cases have been recorded of persons hobbling for long distances with a broken limb, no doubt due to impaction of the broken ends. Fracture of the fibula may cause little disability.

DISLOCATIONS

Dislocations are not frequent in the old or in those persons whose bones are brittle. A witness is liable to be asked, what degree of force, and acting in which direction, would produce a dislocation—questions not difficult to answer. They are not dangerous to life, unless of a compound nature, when death may take place from secondary causes. A dislocation which has occurred in the *living body* may be known after death by a laceration of the ligaments of the joint and of the soft parts in the neighbourhood of the joint, and by the copious effusion and coagulation of blood. If of old standing, a dislocation would be identified by the cicatrices in surrounding structures. Dislocations may occur from *natural causes*, as from disease and destruction of the ligaments in a joint ; also from violent muscular spasm during an epileptic convulsion. They are not very rare as the result of convulsions from whatever cause arising, and when once a dislocation has occurred its recurrence from very slight cause is very frequent. A power of *locomotion* may exist, even when the injury is in the lower limbs. There is of course great pain in the joint on trying to move it or throw weight on it, but under stress of circumstances a person with dislocated ankle, knee or hip may hobble a long way.

A few further remarks on fractures and dislocations will be found under " Malpraxis," for it is chiefly in connection with their treatment that medico-legal questions arise.

SELF-INFLICTED WOUNDS OF A NON-FATAL NATURE

The question whether a wound was or was not self-inflicted may refer to the living as well as to the dead. Thus, a man may produce wounds upon himself for the purpose of simulating a homicidal assault, which, for various motives, he may allege to have been committed upon him.

With the motives for the self-infliction of wounds a medical jurist is not concerned—it is of the fact only that he can take cognisance. One of the most remarkable cases of this kind which have occurred in England was that of *R.* v. *Bolam.*

Bolam was found lying in a room which had been set on fire by himself, or (as he alleged), by an incendiary, and near him was the body of the deceased, who had evidently been killed by violence, the skull having been extensively fractured by a poker lying near. When found, the accused was either insensible or pretended to be so. He stated that he had been suddenly attacked by a man, and knocked down by a blow on the right temple. After attempting to escape, he was again knocked down. He then felt a knife at his throat, but admitted that he did not put up his hands to protect it. His hands were not cut. He said he remembered receiving some blows on his body, but he became insensible and recollected nothing more. On examining his throat, there was a wound an inch and a half in length on the left side of the neck, a quarter of an inch below the jaw. It had penetrated nearly through the true skin, and was of inconsiderable extent. A small quantity of blood, which had flowed down on the inside of his cravat, had escaped from this wound. There were many cuts on his coat at the back and sides, through his waistcoat, shirt, and flannel shirt, but there were no corresponding cuts or stabs, nor, indeed, any marks of injury, upon the skin.

The question was whether these wounds were inflicted by the unknown person who was alleged to have set fire to the premises and murdered the deceased, or whether they were self-inflicted by the accused in order to divert attention and to conceal the crime of which he was accused. No motive for the imputed crime was discovered; but the medical facts relative to the self-infliction of wounds were so strong that he was convicted of manslaughter. There was no doubt that the accused had inflicted the wounds upon himself in order to remove the suspicion that he had caused the death of the deceased. They were superficial, involved no important organs, and bore the features of self-inflicted wounds.

The steward of a club-house in London was found one morning in bed wounded, and the cash-box of the club was missing. Circumstances led the police to suspect that no one could have broken into the house; but the steward was considered so trustworthy that no suspicion was entertained of his having been concerned in the robbery. Bransby Cooper, who examined him, found the wounds on his person of a trivial character; and there was no doubt from what subsequently transpired that they were self-inflicted, for the purpose of averting suspicion.

It is not always easy to trace a motive for the infliction of such injuries; and when a reasonable motive is not immediately discovered, persons are liable to be misled. When a person intending to commit suicide fails in the attempt, he has sometimes, from a sense of shame, attributed the infliction of a wound in his throat to another; but facts of this kind may be cleared up by circumstantial evidence. Imputed wounds, if we except the case of an actual attempt at suicide, in which the injury is commonly severe, are generally of a **superficial** nature, consisting of cuts or incisions not extending below the true skin; deep stabs are seldom resorted to for the purpose of deceit. Further, these wounds are in **front** of the person, and may be on the right or left side, according to whether the person is right or left-handed. They are usually **numerous**, are parallel or approximately so and tend to follow the natural curves of the part without altering their depth, unlike those inflicted by an adversary during a mortal conflict with a weapon. The **hands** are seldom wounded, although in the resistance to real homicidal attempts those parts commonly suffer severely. The injuries are **not** usually situated over those parts of the body in which wounds are by common repute considered **mortal,** and there is in general an entire want of correspondence between the situation of the wounds on the person and the cuts or other marks on the clothing ; or the cuts on the clothing are not reconcilable with an allegation that the articles of clothing were worn when the cuts were received.

In comparing cuts on the clothing with wounds on the person there are several circumstances to be attended to. What articles of clothing were being worn at the time of the assault ? In a case of stabbing all ought to present marks of perforation, corresponding in direction, form, size, sharpness of the edges of the weapon, etc. In imputed wounds the marks on several layers of clothing may not correspond with each other in the features above mentioned. It is very difficult for a man simulating such injuries so to arrange his clothes when off his person as to deceive a careful examiner. There will be some inconsistency or want of adjustment. Apart from the fact that several stabs or cuts cannot exist on the same part of the clothes without one or more being stained with blood on the outside or inside, an imposter may either do too much or too little, and thus lead to his detection.

It must be remembered, however, that, if the clothing is loose, a slashing blow may cause very irregular cuts in the cloth.

A young man alleged that he had received a sword-cut on the forehead from some assailant who had escaped. He stated that he wore at the time a handkerchief round his head, a cotton cap, and a common cap with an elastic front, which he alleged had been cut through. There was a longitudinal wound, quite superficial and about an inch long, at the upper and right part of the frontal bone, passing downwards from *left to right*. The cut in the felt of the cap, which was very soft, passed obliquely from *right to left*, and was about three inches in length. The cut was not so clean or regular as if it had been produced by a sword ; there was very little blood upon the cap, and only on the edge of the incision. The silk handkerchief was cut in an irregular manner. When the person was requested to place the cap and other articles upon his head in the position in which he stated they were when he was attacked, it was found to be impossible to adjust them so as to make the incisions correspond, and the cap could not be worn over the folded handkerchief. This rendered it certain that the wound had not been inflicted in the manner described. Besides, a blow of a sword which would have divided the felt and silk handkerchief would at the same time have produced a much deeper wound on the forehead than that which was found.

In a case of alleged arson to defraud a fire insurance company, which excited much public discussion in London some years ago, a simple circumstance led to the conclusion that certain stabs or cuts through a shirt had not been produced while the shirt was on the body. There were two cuts in the shirt near to each other, precisely similar in size, form, and direction ; in fact, the knife or dagger producing them must have gone through a fold of the shirt to produce them, so accurate was the correspondence. Then, however, it followed that the shirt could not have been upon the body of the wounded person, as he alleged, because a **stab through a shirt** when worn over the skin must, in order to reach the body, traverse not only a fold (producing two cuts), but another layer in contact with the skin, and thus produce **three cuts,** or in the event of traversing two folds, **five cuts.** In simulating the wounds by cuts on the shirt, the person is supposed to have forgotten this and have merely stabbed a fold of the shirt while lying on a table, or in some situation convenient for the purpose. This, among other facts, rendered it probable that the slight wounds on the chest were self-inflicted. A case occurred at Nottingham which shows how persons who inflict wounds and at the same time cut the clothing covering the wounded part may furnish evidence against themselves.

A youth charged a man with unlawfully wounding him on the highway. He stated that the man had stabbed him in the arm, cutting through his shirt and coat-sleeve. There was no attempt at robbery, and no motive for such an act. On examining the coat and shirt-sleeve it was found that they had been cut, but there was no corresponding cut in the lining of the coat-sleeve. The prosecutor could give no explanation of this. It was clear that the charge was false, that there had been no cutting or stabbing by another, but that the wound was self-inflicted when the coat was not being worn.

It has been contended that no rules can be laid down for the detection of such cases; each must be decided by the facts which accompany it. Nevertheless the details of those above mentioned will serve to direct the inquiries of a practitioner. The facts which he must endeavour to ascertain are the following:

1. The relative positions of the assailant and the assailed person at the time of the alleged attack.
2. The situation, direction, and depth of the wound or wounds.
3. The situation or direction of marks of blood or wounds on the person or clothing of either, or of both the assailant and assailed.
4. The marks of blood and the quantity effused at the spot where the struggle is alleged to have taken place.

Imputed wounds are generally *cuts* or *stabs*. They are seldom contused, for the impostor cannot so easily calculate upon the amount of mischief which is likely to ensue. Cases are recorded in which women suffering from hysteria have inflicted upon themselves severe contusions, and have charged innocent persons with attempts to murder. In general the inconsistency of the story is sufficient to betray the imposture.

The case where a merchant of Montpellier was charged with having committed a murderous assault upon his servant was rather one of imputed homicidal strangulation than of imputed wounding; nevertheless a foundation was laid for medical opinion by the presence, as it was alleged, of a slight excoriation of the skin on the nape of the neck. The injury was so slight that it escaped the observation of some medical men who examined the complainant, and there could be no doubt from the facts that it had been produced either accidentally or designedly by the complainant on himself. Several medical men, taking the man's story as true, asserted without any qualification: (1) That a blow on the nape of the neck might produce cerebral concussion and syncope; (2) that a blow to produce such effects need not be violent; and (3) that such a blow so inflicted would not always leave upon the skin marks of contusion and ecchymosis. These admissions were taken by the court to support the man's story—that his master struck a severe blow on the back of his neck, and this had produced concussion of the brain, and that he had been rendered insensible for many hours. The evidence for the defence removed the effect produced by such loose medical answers as these, and satisfied the court that the statement of the complainant was a pure fabrication. The accused was acquitted of the charge.

Although it has been elsewhere stated that severe blows are not always attended with external marks of violence (p. 294) it by no means follows that such blows have been struck in all cases in which the skin presents a slight abrasion.

In *R.* v. *Wiggins* a man was tried and convicted of the murder of a woman with whom he had been living.

The woman was found dead with a wound in her throat which divided the carotid artery, the internal jugular vein, and the windpipe. It began on the left side far back, penetrating as by a stab perpendicularly towards the spine, the bones of which had been indented by the violence of the blow. Death must have speedily followed. There was a wound on the neck of the prisoner, beginning on the left side, going in a direction from left to right and from above downwards. It was quite superficial, involving only the skin and the external jugular vein. The prisoner alleged that the deceased had cut his throat while he was lying on the floor asleep, and that the deceased had afterwards committed suicide. A close examination of the wounds showed that on the prisoner's neck there was a superficial cut such as a man might easily produce on himself, while the wounds on the neck of the woman were such as were not likely to have been self-inflicted. The prisoner gave two accounts which were inconsistent with each other, and with the facts proved. Among the circumstances which were inconsistent with his statement was the following:—He produced a neckerchief which he said he wore while lying down, and showed the constable a cut in it which, according to him, was produced by the deceased while attempting to cut his throat. The neckerchief was of thin red cotton in sixteen folds. It was nearly transversely cut across the folds, the edges clean and sharply cut, and neither stained nor stiffened with blood. It could not be made to correspond in any way with the cut in the neck. It was nearly at right angles to it, and on the opposite side of the neck as it was worn. It was clear that the cut must have been made on this neckerchief when it was not upon the neck, and with a clean knife.

R. v. *Hindle* was a clear case of self-inflicted wounds.

The prisoner, a youth of 15, was accused of the murder of a woman, *æt.* 61. The prisoner and the victim were alone in the house. The prisoner alleged that he found a strange man strangling the victim, but, being disturbed by the prisoner, he slashed her throat and disappeared. Before he did so, however, the prisoner seized him by the coat-tails, when the stranger drew his knife across the prisoner's arm, making seventeen or eighteen cuts. Blood was found in parts of the house and in the street, in directions different from the way the stranger was said to have escaped, while there was none the way he was said to have gone. It was shown that no one passed through the back way as alleged, and that not a single cry of "Murder!" was heard, although the prisoner said that he had cried out several times as he pursued the escaping man. A careful examination showed that no one had passed over the door, for the dust had not been disturbed, and there were no scratches upon it. There was not a single thing to indicate that the door had been touched in any way. There was strong evidence that the prisoner's story was untrue. Instead of pursuing a man along the back passage, the prisoner was seen to come out of the front door, and turn into the passage leading to the back door. Downstairs, in the front shop were drops of blood, showing the exact course taken by the prisoner. Undoubtedly the deceased had been throttled. The actual cut upon the throat had been inflicted by a knife belonging to the deceased's son, the whereabouts of which could not be known to a stranger, and, as it was of peculiar construction, it was hardly likely that it could be used by a stranger. It was in the son's bedroom, and to get possession of it a person would have to go through the sitting-room. The prosecution alleged that the whereabouts of the knife and its peculiar construction were known to the prisoner, and that he used it for the purpose of committing the murder.

The medical witnesses agreed that the wounds on the prisoner's arms were mere scratches, some fourteen to twenty in number. The victim had died from hæmorrhage from the throat combined with strangulation. The judge said that it was incredible that a man who had risked everything for the purpose of committing murder would have inflicted only scratch wounds upon a person who endeavoured to prevent his escape. He would not have hesitated to commit another murder when it was necessary for his own safety. None of the furniture in the room had been upset or disturbed. There was nothing to show that a struggle had taken place, except that the carpet was a little ruffled.

CHAPTER X

THE EXAMINATION OF BLOOD STAINS

PRELIMINARY EXAMINATION

It may appear at first sight an easy matter to say whether certain suspected spots or stains on articles of clothing, furniture, or weapons are or are not caused by blood ; but in practice great difficulty is often experienced. If the stains are large and recent, many people may be competent to form an opinion ; but even in such cases it is desirable to have scientific proof of the presence of blood. The physical features of blood are soon changed, even when the material is white and otherwise favourable for an examination. If the stains, whether recent or of old standing, are upon dark-dyed woollen materials such as blue, black, or brown cloth, or if they appear in the form of small or detached spots, or in thin films on dark clothing or rusty weapons, no opinion should be given without complete tests.

It is advisable before blood stains are removed or interfered with in any way to examine them carefully for the presence of foreign substances embedded in them, such as fibres, hairs, etc., which may prove of value at a later stage. Their position, shape, size and relationship to surrounding objects should be recorded by means of a photograph or sketch. The position and appearance of the blood stains may prove of the utmost importance in the reconstruction of the crime.

Examination by the naked eye or simple lens. The colour is thus observable, and, if caused by blood, will be either red or brownish red through darker shades to a colour nearly black, the colour depending on its age, its quantity, the materials on which it is found, and the treatment to which it has been subjected. It is not possible from the colour of the stain to be sure of its age.

If the stain is caused by blood, it will not be a mere colouring of the fibres, but it will have a shining glossy appearance, and each fibre will be observed to be invested with a portion of dried coagulum or clot. In other cases minute coagula or clots presenting the appearance of dried jelly will be seen in the meshes of the stained article of clothing. In certain lights the clots may appear of a dark red colour, but by changing the light bright translucent portions of a crimson tint will come into view. Small fragments of crushed fruit or jam or other pigment may cause a somewhat similar appearance, but these will easily be detected on analysis. When the stain is on black or dark-coloured cloth, no colour will be visible. If caused by blood, the fibre will, however, be stiffened, and when viewed by reflected light it may appear glossy, owing to the drying of the clot.

After thoroughly examining every stain by the naked eye and either hand lens or dissecting microscope, the examiner should proceed on definite lines. It is advisable to apply first a general test such as the benzidine test by means of dry filter paper. If this test is positive then specific tests, chemical and physical, for the presence of hæmoglobin, should be applied to minute portions of the stain, then biological tests for the origin of the blood, human or otherwise, and finally tests for the group of the particular blood.

Microscopic Examination. An attempt should be made to obtain a specimen of the cells in the stain for microscopic examination as described on p. 403 before proceeding to the chemical tests.

Methods of obtaining material for analysis. These depend upon the fact that the red colouring matter of blood is more or less soluble in water; when quite fresh, and therefore in the condition of hæmoglobin, either oxidised or reduced, it is easily soluble in cold water; when it is older, and consequently contains a considerable proportion of methæmoglobin or of hæmatin, its solubility in plain water is proportionately diminished; and if it be entirely converted into hæmatin, and perhaps even into iron-free hæmatin, it requires menstrua with greater dissolving power. The rapidity of solution in water or normal saline and other solvents give some indication of the age of the stain, but is subject to so many variations that no precise opinion about the age is usually possible. Several menstrua have been suggested and used for dissolving more obstinate blood stains. Amongst the simplest, and therefore the best, of these are (*a*) a saturated solution of borax in distilled water; (*b*) a 10 per cent. solution of glycerine in distilled water; (*c*) a weak solution of ammonia, the ordinary liquor ammonia of the British Pharmacopæia serving very well. Heat has a somewhat similar action on hæmoglobin to that which age exerts, breaking it up into hæmatin and globulin. In the case of a dead body found burnt, or pieces of charred furniture and similar articles which have been exposed to considerable heat, but with stains on them resembling those of blood, due allowance must be made for this change by prolonging the efforts at obtaining a solution, or by using other methods which will be described.

Whatever be the material which is submitted to an expert for examination, the same method of procedure must in the first instance be adopted, viz., to place the suspected material in a small quantity of one or more of the above solutions. If no coloured solution is obtained at once, the vessel in which the investigation is going on must be carefully protected from dust and left for from twelve to twenty-four hours. It is practically certain that if blood be present there will by this time have appeared a red or reddish brown coloration in the liquid, or if minimal quantities are being dealt with that it will be possible with a glass rod to squeeze out on to a glass slide a drop or two of a similarly coloured fluid. Oil or grease in a stain interferes considerably with the solubility of blood stains, and if this is present the stain may be first brushed over with a little ether, in which oils and fats are readily soluble. From a metal weapon a piece of coagulum or a suspected spot must be scraped off with great care so as to prevent it being mixed with rust. Stains on wood, leather, etc., may be gently scraped into a watch glass, stains on clothing may be scraped off or a fragment of the material cut and also placed in a watch glass. The specimen so obtained is then moistened with a small quantity of water or normal saline and allowed to stand until a solution is obtained. If the weapon or material has been exposed to heat, so as to destroy the blood pigment, a dilute solution of ammonia may be advantageously used.

The criminal classes are very ignorant of the best methods of removing blood completely from an article ; nevertheless it is possible that the above procedure may be futile, for an attempt may have been made to wash out blood stains, so that the colour may be more or less changed or entirely discharged and no chemical evidence obtainable. There is a common notion that certain chemical agents will remove or destroy these stains, but this is not always the case ; the colour may be altered, but when dried on the stuff it is not easily discharged nor bleached. Chlorine, a most powerful decolorising agent, turns the colouring matter of blood to a green-brown colour. Nothing removes a blood stain, whether wet or dry, so effectually as simple maceration in *cold* water, or in a saturated solution of borax, although, when the stain is old, the process is slow. *Washed stains* may be detected by means of the benzidine, guaiacum, or other colour test, but it is extremely difficult to obtain conclusive evidence of the presence of hæmoglobin if the stain has been well washed. Nevertheless, the fact that the benzidine test is positive is important to note, for example, in a recent case (*H.M. Advocate* v. *Porth*, Nov., 1944), the trousers of the accused gave a positive test over the front of the knees and round both side pockets, as did his tie and shoe laces. Blood was found in the instep of both shoes with fibres from the coat of the victim embedded.

In *R.* v. *Baker*,[1] where a girl had been murdered and mutilated, the trousers of the prisoner sent for examination were stained with blood in front. An attempt had been made to remove these stains by soaking them in water. This had carried the red colouring matter into the calico lining, and had given to some patches a strong and to others a pale, reddish tint. The guaiacum and peroxide of hydrogen test indicated blood over a square foot of the calico lining ; beyond this these liquids produced no change. The degree of the diffusion of the blood, as it had been washed from the front of the trousers into the lining, was thus clearly defined.

TESTS FOR BLOOD

The Benzidine Test. This is the best preliminary test for blood, and by means of it a large number of possible stains may be examined and those that give a positive test marked out for further examination.

It is a negative test—that is to say, if a positive result is obtained it is not proof of the presence of blood, but if no positive test is obtained it is proof that the stain is not blood and need not be further examined.

The test depends on the presence in blood stains of a peroxidase or similar substance which in the presence of hydrogen peroxide oxidises the colourless benzidine sulphate into a rich blue-coloured salt. The reaction is given more readily with blood than with any other substance, but a reaction can be obtained with pus and certain plant and animal juices which contain oxidase, and also with commercial formalin. According to Callow, the test is given by many bacteria such as B.Coli prodigeosis, fæcalis, etc.[1] Benzidine sulphate is readily oxidised to its blue salt by any oxidising agent such as permanganate of potash, chromates, etc., in the absence of hydrogen peroxide, so that it is essential in performing the test to add the benzidine solution first and observe whether any action occurs before adding the hydrogen peroxide. If a blue colour is obtained without adding the peroxide, the test is valueless.

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[1] Hants. Aut. Ass., 1867.

The solutions used are :—

(*a*) Benzidine [paradiamo-diphenyl] sulphate dissolved in glacial acetic acid to form a 10 per cent. solution, or stronger if desired.

(*b*) Fresh active Hydrogen Peroxide (20 vols.).

A piece of white filter paper is pressed on the stain, a few drops of the benzidine solution are run on to the paper and left for half a minute to ascertain whether any colour change occurs, then a few drops of hydrogen peroxide are run over the benzidine on the paper.

If blood is present in however minute a quantity a blue colour appears at once when the hydrogen peroxide is added. If it should appear before adding the peroxide it indicates the presence of any oxidising agent, but not blood. On no account must the reagents be added to the stain *in situ*, for that would interfere with the subsequent tests. Instead of rubbing the stain with dry filter paper a minute fragment may be scraped off the specimen on to the paper, but this is usually not as good as the former method.

The test is given by blood of almost any age, blood that has been subjected to heat or cold, blood stains treated with carbon tetrochloride, benzine and similar cleaning agents. It is given when a blood-stained article touches another, or when a blood-stained hand is placed in the pocket, even when the stain is dry, and on articles on which no trace of blood can be seen by the naked eye or lens. It is, therefore, invaluable in localising stains which may be due to blood.

There are a number of tests similar to the benzidine test and depending equally on the presence of peroxidase ; for example, the guaiacum test, the leucomalachite green, the phenolphthalein, the pyramidon tests, etc., but these offer no particular advantages over the benzidine test.

The Guaiacum Test. If to a little of the watery solution of the stain a few drops of alcoholic solution of guaiacum resin—the tinct. guaiaci of the old Pharmacopœia is a very convenient preparation for the purpose —be added, a dirty reddish brown precipitate is formed. A little ozonic ether or solution of peroxide of hydrogen is then added, when the mixture will assume more or less rapidly a beautiful deep blue colour, or if ozonic ether has been used the ether which floats on the mixture or rapidly rises to the surface after thorough mixing is coloured blue.

The Phenolphthalein Test (Kastle Mayer Test). This test also depends on the presence in blood of a peroxidase, and, like the guaiacum and benzidine tests, must be considered in its true character—that is, as a test for peroxidase, and not as a test for blood.

It is well to remember this, for assertions are constantly being made that one or other of these tests is a definite test for " blood."

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[1] *Biochem. Journ.*, 20 : 247, 1926.

The reagents for the phenolphthalein test consist of two substances, hydrogen peroxide (20 vols.) and phenolphthalein.

The latter is prepared as follows :—

Phenolphthalein	2 grm.
Hydroxide of potassium	20 „
Distilled water, to	100 cc.

These are boiled, and while boiling 20 grm. of powdered zinc are added. Boiling is continued until the solution is colourless. This solution keeps fairly well if a little zinc is left at the bottom of the bottle.

To carry out the test a few drops of the reagent, followed by a few drops of hydrogen peroxide, are added to a solution of the stain in water. If blood is present a pink or purple coloration is at once produced. The test is extremely delicate, giving reactions with dilutions of one part of blood in five millions. Unfortunately the test is equally delicate for traces of copper and other substances.

If a positive preliminary test is obtained, the presence of hæmoglobin must be proved. This may be done by spectroscopic examination or by chemical tests for hæmin crystals or other crystals derived from hæmoglobin.

In practice the spectroscopic examination of the material is preferable owing to its rapidity and if desired a compound test for spectroscopic absorption and the identification of crystals presents itself in the Takayama or hæmochromogen crystal test (*q.v.*).

Spectrum Analysis—Spectroscopic Test. The great advantage of this optical process is that it admits of the examination of blood without in any way interfering with the subsequent application of chemical tests. We simply analyse the light as it traverses a solution of the red colouring matter, and with a spectroscope attached to a microscope we notice whether the coloured spectrum has undergone any change. If the red liquid owes its colour to recent or oxidised blood, two dark absorption bands will be seen breaking the continuity of the coloured spectrum (No. 1, fig. 25). These are situated between the *D* and *E* lines of the solar spectrum. The less refrangible of the two bands is the sharper and better defined of the two. If the blood is quite recent and of a bright red colour (**oxyhæmoglobin**) the two absorption bands are both distinct and well defined. A good light—either artificial or daylight—is required ; the coloured liquid should be clear and of sufficient intensity, and the spectrum apparatus properly adjusted. The blood may be placed in a narrow glass tube, or in a glass cell contrived for the purpose. The spectroscope should allow of two tubes being examined at once, for it is desirable to have a specimen of blood mounted for comparing the actual spectrum of blood with that of the suspected liquid.

In the course of an hour in warm weather, and after a day or two in cold weather, the blood in the tube undergoes a change. It loses its scarlet and acquires a purple colour (**reduced hæmoglobin**). In this state the two bands appear blended, and one broad black band only is seen (No. 3, fig. 25). The blood undergoes deoxidation, for on removing it and shaking it with air in the tube it becomes again bright, and the two bands reappear. The same change from a two-banded to a one-banded spectrum is effected by the addition of an ammoniacal solution

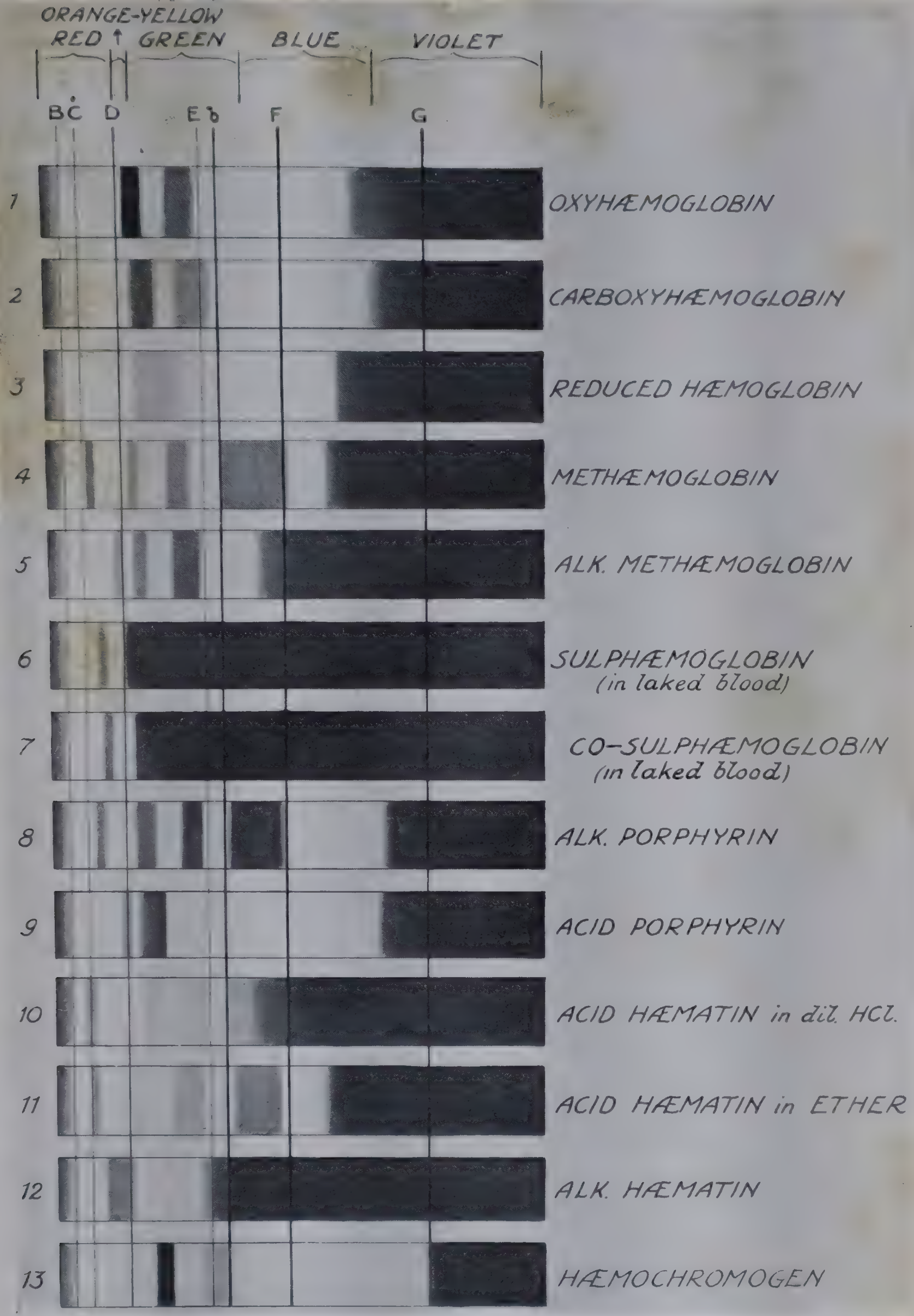

Fig. 25. Absorption spectra of hæmoglobin and its derivatives.

Wavelengths in Angström units of Fraunhofer's lines B, 6867; C, 6563; D, 5893; E, 5270; b, 5184; F, 4861; G, 4308.

from Harrison, Chemical Methods in Clinical Medicine.

To face page 400.

of ferrous tartrate (Stokes' solution). This solution is made by dissolving a fragment of ferrous sulphate in water, adding an excess of tartrate of potassium, and then enough of a dilute solution of ammonia to dissolve any precipitate which may have formed. The solution must be freshly prepared for use.

Methæmoglobin. When a solution containing blood is exposed to the air for some time it loses its blood-red colour, and assumes a brownish tint. If it is examined by the spectroscope it will be found that a new absorption band has made its appearance between the *C* and *D* solar lines, but somewhat nearer to *C* than to *D* (No. 4, fig. 25). This is the band of the so-called methæmoglobin.

Methæmoglobin may be formed *in vitro* by many substances, such as ferricyanide of potash, permanganate of potash, etc., and it is formed *in vivo* by nitrites, antifebrin, acetanilid, etc., It contains the same amount of oxygen as oxyhæmoglobin, but whereas the oxygen in the latter may be removed by the action of a vacuum pump, the oxygen in the former is fixed. It is, therefore, of no value as a respiratory pigment.

Hæmatin. If a solution containing hæmoglobin is acidified with acetic acid, the pigment is decomposed, the solution acquires the brown-red hue of an old blood stain and hæmatin is formed. The same change is effected by prolonged exposure of blood to air. Hæmatin in acid solution affords a spectrum the number of bands in which varies according to the solvent employed (Nos. 10 & 11, fig. 25). Its acid solution in water has a very marked absorption band, extending from about midway between the *C* and *D* solar lines up to *C* at the red end of the spectrum. If the solution be now made alkaline with dilute ammonia, the band shifts towards the blue end of the spectrum; it is indistinct and just touches the *D* line at its most refrangible border.

Hæmochromogen, or reduced alkaline hæmatin, is obtained from blood by the action of strong reducing agents in the presence of an alkali. It possesses a most characteristic absorption spectrum comprising two well-marked bands (No. 13, fig. 25). The first of these is in the yellow part of the spectrum almost midway between the *D* and *E* lines, the second in the green, broader, but less distinct.

It is commonly prepared by adding Stokes' reagent or a strong alkali and yellow ammonium sulphide to the solution of the blood stains. A better reducing agent, especially for microspectroscopy, is a solution of sodium hydrosulphite ($Na_2S_3O_4$) made up as follows: 2 grm. of sodium hydrosulphite are shaken up with 5 c.c. of a 10 per cent. solution of sodium hydroxide in a test tube with a rubber cork, and 1 c.c. of alcohol added. It must be kept corked and made up freshly for each batch of blood stains. Takayama's solution (p. 405) is also useful for this test.

Hæmatoporphyrins. If a fragment of stain is treated with a drop of strong sulphuric acid, the hæmoglobin is broken up, and a new iron-free derivative is produced known as hæmatoporphyrin.

If the reaction takes place on a slide it may be examined directly under the microspectroscope, when the characteristic bands of acid hæmatoporphyrin will be observed. These consist of one thin well-defined band on the red side of the *D* line (608-594) and a broader band which can be resolved into two on the purple side of *D* (584-548).

Alkaline hæmatoporphyrin may be prepared from the above specimen by gently washing off the sulphuric acid and adding a drop of strong caustic potash solution to the preparation. The absorption spectrum of this substance consists of four bands : one between *C* and *D* (620-612), two between *D* and *E* (594-568), and a fourth in the green (527-448).

A blood stain, however minute, may, if more or less recent, be made to yield successively all the spectra depicted in Fig. 25 ; but old blood stains which have become insoluble may yield the spectra only of hæmatin and of the so-called reduced or alkaline hæmatin (hæmochromogen).

Relationship of Hæmoglobin to other Pigments. Our knowledge of the nature of hæmoglobin and its relationship to other naturally occurring pigments has been extended considerably by recent work. Hæmoglobin is generally confined to vertebrates and occurs only rarely in other animal groups ; but a number of oxygen carriers have been discerned in invertebrates, sometimes in special cells, sometimes dissolved in the body fluids.

The hæmoglobin molecule consists of four red pigment groups known as hæms and a colourless protein residue called globin. Hæm has no characteristic spectrum, but it can be combined with globin or globin substitutes to form hæmochromogen. Several nitrogenous substances, such as pyridine, hydrazine hydrate, nicotine, etc., combine with hæm to produce hæmochromogens which have nearly similar absorption spectra.

This basic substance hæm is found in many other naturally occurring pigments, such as helicorubin, actinohæmatin and cytochrome. The latter is of great interest, for it is found not only in the animal kingdom, but also in bacteria, in yeast, and in the higher plants.

Fischer and his co-workers have claimed to have produced porphyrins from yeast and from other substances free from chlorophyll and to have obtained the spectrum of hæmochromogen from them.

Keilin suggests that this is due to the presence of cytochrome. Space does not permit a discussion of these interesting questions, but readers may obtain full details in the following publications : Barcroft, *Physiological Reviews*, 1924 ; Anson and Mirsky, *Journ. Physiol.*, 1925 ; Keilin, *Proc. Roy. Soc.*, 1925 ; Schumm, *Zeit. Physiol. Chem.*, 1925-26 ; Pryde, " Recent Advances in Biochemistry " and numerous papers.

Microscopical and Micro-chemical Examination

Attention has already been drawn to the examination of a suspected stain with a lens with the object of discovering small coagula of fibrin on the meshes of a dress material or the surface of non-absorbent stuff, such as stone. The further microscopical tests for blood consist of the demonstration of : (1) The red corpuscles of the blood ; (2) Crystals of hæmin or chloride of hæmin ; (3) Crystals of Hæmochromogen.

It is desirable when making films for the examination of red cells to make a complete examination for other cells and foreign substances at the same time. For example, there may be certain peculiarities or pathological conditions of the blood which may be detected ; there may be numbers of leucocytes, bacteria of different kinds, cells from particular parts of the body, hairs, fibres, etc., all of which may be of importance for the identification of the stain and the reconstruction of the crime.

1. **The Discovery of Corpuscles.** There are only two conditions in which it is possible to find the corpuscles of the blood in a state fit for microscopical examination :—First, that the stain shall be quite fresh, and (or) second, that a small fragment of clot shall be available for experiment. When the corpuscles have dried (and in the dried state they are unrecognisable by microscopic observation), it is only with extreme difficulty that they can be induced to return to their normal size and shape.

A portion of the stain or fragment of clot may be removed and macerated in one or two drops of normal saline on a glass slide. It should be covered with thin glass, in order to prevent rapid evaporation.

Many other fluids have been recommended for this purpose, a full description of which may be found in Sutherland's "Bloodstains," but probably Vibert's solution consisting of common salt 2 grm., mercuric chloride 0.5 grm., distilled water 100 c.c., is as good as any.

After moistening a fragment of the stain on a glass slide a cover slip with vaselined edges is applied, and the preparation warmed in the incubator at 37° C. for half an hour. It is then examined directly, and if nothing is to be seen, the specimen is to be gently teased out and re-examined.

The corpuscles of the blood may be recognised, though they are seldom so perfectly spherical as in the fresh state, and they appear small, and frequently shrunk or corrugated. In some cases only fragments of the envelopes can be seen.

2. **Hæmin Crystal Test.** (Teichmann's test). This test was first described by Teichmann in 1853, and still remains a valuable and conclusive test for the presence of blood. Teichmann found that when a small quantity of blood was heated with glacial acetic acid, a crop of brown rhombic crystals developed on cooling.

These crystals are due to the formation of hæmin hydrochloride from hæmoglobin by the action of the sodium chloride present in the blood and the added acid.

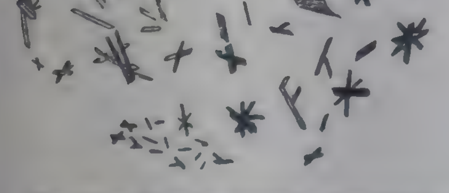

Fig. 26.—Hæmin-crystals, magnified 517 diameters.

The method is as follows :—A small dry fragment of clot, or a bit of the suspected material, is placed upon an ordinary microscope slide; a few drops of glacial acetic acid are then added, and the acid and material thoroughly incorporated by means of a glass rod. The smallest possible fragment of common salt is then added ; a thin cover slip is placed on the top of the fluid, and the slide is waved to and fro over a Bunsen flame till active ebullition occurs (some little care and dexterity is required for this little operation, or the slide may be shattered by the heat or the cover slip blown away) ; the slide with its contents is then allowed to cool. The residue is examined by a microscopical power of 300 to 500 diameters. The hæmin-crystals, if present, appear in groups, as small dark brown specks. They are somewhat irregular in shape—have generally a prismatic form, some with rhombic terminations, while others assume a spindle shape ; and others again are joined at an angle, so as to resemble a bird's tail, or they cross each other like the letter X.

To ensure the production of crystals, three points must be remembered: the acid must be anhydrous, the stain or fragment must be dry, and the slide must not be overheated.

A modification of the test which has proved very useful is to substitute a solution of sodium chloride, bromide, and iodide, each 0.1 per cent., in glacial acetic acid. This solution keeps well, and with it the test is more easily carried out than with the original technique.

Another modification which was proposed by Beam may be found of value in those cases where crystals are difficult to obtain by the ordinary methods.

Beam's Modification of Teichmann's Test.[1] A small quantity of the suspected material is placed at the bottom of a flat arsenic sublimation tube about 6 by 3 mm. wide, and 35 mm. long.

"A thin round ignition tube will answer if no flat tube is procurable, but for examination under the microscope the flat form is obviously better. A few drops of acetic acid containing from 0.01 to 0.1 per cent. sodium chloride are added, and a very fine cotton thread adjusted, so that its upper end is near the top of the tube and the lower end reaches to the bottom of the liquid. The thread should be everywhere in contact with the tube, to which it adheres readily by being moistened with the liquid. The adjustment is readily made by means of a glass rod, one end of which is drawn out for the purpose. The tube is now placed in a rack, or supported by forcing its base into a small blob of plasticine, and allowed to remain until crystallisation has taken place.

"Before placing the thread into position the solution of the blood may be aided if desired by cautiously heating the tube over a small flame, loss of the liquid by explosive boiling being prevented by holding the finger tightly over the mouth of the tube.

"While such heating appears rarely to be essential, the long contact with the acid in the cold sufficing for solution in practically all cases, it is nevertheless advisable in that it gives at once an indication of the strength of blood solution obtained. For the best results this should be quite weak. The clear liquid, filtered by its passage through and along the thread, is slowly drawn up by capillary action to the mouth of the tube. Under these conditions evaporation takes place so slowly that, even when the temperature of the atmosphere is above 38° C., it is complete (if the tube is held in an upright position) only after twelve to twenty-four hours or more. The rate of evaporation is readily controlled, within wide limits, by altering the dimensions of the tube and the angle at which it is supported.

"The crystals usually begin to appear on or near the upper half of the thread, and are of sufficient size to be distinguished with a power of 75 diameters, in about an hour; and they ultimately become so large that, in place of requiring a magnification of 250 to 300 diameters, as usually recommended, they may readily be seen with one of 25 diameters, or even, in many cases, with a good hand lens. The crystals are best viewed against a dull white background. A piece of white paper is suitable.

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[1] Beam and Freak, *Biochem. Jour.*, vol. 9, No. 1, March, 1915.

" The extraordinary large size of the crystals is due, in great part, to the slow evaporation of the liquid ; but it is also a result of the removal by the thread, of the interfering action of the blood albumen on crystallisation. Examination of the thread at the end of the experiment shows that the soluble, non-crystallisable constituents of the blood are carried to its upper end, and that the maximum growth of hæmin-crystals is found lower down.

" If the solution is sufficiently weak, the first crystals form at the point of greatest concentration—the upper end of the thread ; but as the albuminous matter accumulates, these cease to grow, and the largest and most numerous crystals are found later about midway down the tube.

" For the best results the following precautions should be observed :

" The tube should be thoroughly clean and dry. It is best cleaned by swabbing out successively with acetic acid, water and alcoholic soda, followed by thorough rinsing with distilled water and drying on a hot plate.

" The thread should be clean and as fine as can be obtained. A good plan is to take No. 80, ' six-cord sewing machine cotton,' and to untwist it, using one of the ' cords ' for the test.

" The solution of the blood in acetic acid should not be concentrated, but very weak. The liquid should only be faintly pink. This ensures large crystals and clean fields.

" If the method is to be applied experimentally to fresh blood, the latter must be completely dried before the addition of the acid, and especial care should be taken to work with very dilute solutions."

3. **Hæmochromogen Crystal Test.** The hæmin-crystal test is occasionally difficult to obtain, and we have found the hæmochromogen crystal test to be equally good and more easily carried out. It has the additional advantage that the crystals can be examined and their nature confirmed by the spectroscope. Takayama[1] worked out a simple technique for the production of the crystals, which is fully described by Kerr and Mason.[2]

A test solution is prepared as follows :—

Sodium hydroxide (10 per cent.)	3 c.c.
Pyridine	3 ,,
Saturated solution of grape sugar . . .	3 ,,
Distilled water	7 ,,

A few drops of this solution are added to a small portion of the suspected stain on a slide and a cover slip applied. On examination under the low power of the microscope, pink crystals are formed in ten to thirty minutes in the cold, or at once if the preparation is heated until bubbles appear.

These crystals are something like hæmin-crystals, rhomboid in shape, salmon pink in colour, and disposed in clusters, sheaves and other formations. On spectroscopic examination the absorption spectrum of hæmochromogen is seen.

1. Is this Stain Blood ?

The preliminary examination with the naked eye and a lens commences the process of differentiation thus : Iron-mould stains and stains from cochineal, and the red colours of wine, flowers, and fruit, do not cause any stiffening of the fibre of the stained stuff, nor any appearance under the lens at all resembling a direct coagulum of blood; and, again, of the various red colouring matters extracted from vegetable and animal substances, there are none which, to the experienced eye, present in a stain on any fabric the peculiar crimson-red tint of dry blood, especially when the substance is examined in a good light.

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[1] *Japanese Journ. Toxicology*, 1912.

[2] *B.M.J*, January 23rd, 1926.

In the next step of examination, *viz.*, that of obtaining a solution for examination, we know that blood in all stages is soluble in one of our menstrua. If a microspectroscope is available it is not necessary to make a solution of the stains. A fragment may be treated on the slide as detailed above. Insoluble stains may frequently be detected by their special characters, thus: *Iron-moulds* are of a reddish brown colour, sometimes of a light or orange-red. They are quite insoluble in water, but are easily dissolved by diluted hydrochloric acid, and on adding ferrocyanide of potassium to the hydrochloric solution the presence of iron will be at once apparent. Care should be taken that the acid used for this purpose contains no iron. A more satisfactory method of testing is to apply to the spot glacial acetic acid, followed in a few minutes by a solution of tannic acid. A bluish purple stain of ink is produced, thus indicating that the spot is owing to oxide of iron. Tannic acid alone has no action on iron-moulds. Notwithstanding these well-marked distinctions, mistakes are sometimes made, as in the following case:—

Many years ago a man was found drowned in the Seine at Paris in suspicious circumstances. The body had evidently been a long time in the water. On examining the shirt of the deceased a number of red-brown stains were observed on the collar and body, resulting, it was thought, from spots of blood, which had become changed by time. On a chemical examination, however, they were found to be iron-moulds, produced by the rusting of a steel chain which the deceased had worn round his neck.

Red Paint. Stains made with red paint containing ferric oxide have been mistaken for blood. They may be easily known by digesting them in diluted hydrochloric acid and applying to the solution the tests for iron. Like those produced by iron-moulds, they are insoluble in water. The same may be said of spots of the ammonio-nitrate of silver changed by light, which the author has nevertheless known to be mistaken for old stains of blood. The stuff on which the spots of blood are found may be itself stained with a fixed red dye or colour; madder when mordanted is thus quite insoluble, and a cochineal stain may give no colour to water; or it may be dyed with iron; in this case it will be necessary to test by the same process pieces of the coloured and stained portions, in order to furnish evidence that the suspected stains are due to blood.

In *R.* v. *Spicer* an apron which the accused wore was found with stains of blood upon it; but the greater part was covered with dark red stains, which turned out to be owing to a logwood dye that the accused had used in his business.

In *R.* v. *Muller* a question arose whether there was dried coagulated blood upon a life preserver which the accused might have used. The weapon consisted of a heavy mass of lead, enclosed in a network of string, and secured to a whalebone handle. There was a substance on the network resembling dried blood. When this was removed and placed in contact with water, it was not dissolved, and, under the microscope, presented the appearance of brown flakes, which gave no colour to the surrounding liquid. On applying a red-hot platinum wire to the supposed coagulum, it melted, and gave off the smell of resin. It was part of a resinous composition which had been used for securing the lead to the network; it had become softened by heat, and had oozed out between the meshes. No blood could be detected in any part.

Supposing, however, that we have thus obtained a solution so that a fluid with some resemblance to the colour of blood is submitted for examination, the chemical tests offer very considerable evidence of a definite nature. Among such soluble stains and solutions are those produced by the juices of fruits, currants, gooseberries, plums, etc., solutions of cochineal and other red dyes. When solutions of these red colouring matters are treated with ammonia, some—such as cochineal, logwood, and the colours of roots and woods—acquire a deep crimson tint; while others, such as the red colours of flowers and fruits, are changed to a blue or green. These red colours are not destroyed by a boiling temperature, and even when mixed with albumen this is coagulated, but the red colouring matter remains unchanged. In the case of blood, the effect of heat is to destroy the colour entirely, but the treatment with ammonia simply, without the heat, merely turns a solution of blood somewhat browner or has no effect upon it at all. Examination of the stain by the spectroscope effectively proves or disproves the presence of blood.

There is often a remarkable resemblance to the stains of blood on metal, produced by the *oxides or certain salts of iron with vegetable acids:* If the juice or pulp of lemon or orange is spread upon a steel blade, and is exposed to the air for a few days, the *citrate of iron* formed presents the appearance of a blood stain, but gives none of its tests. *Citrate of iron* is soluble in water, forming when filtered, a yellowish solution which undergoes no change of colour on the addition of ammonia. If in the state of persalt, it is rendered blue by tincture of guaiacum alone. It is at once identified as a ferric salt by giving a blue colour with the potassium ferrocyanide.

In old blood stains on rusty weapons, the rust, the blood and perhaps food particles, are mixed together, and require to be separated; water, or ammonia solution, will in time do this so far as the blood is concerned, and the coloured fluid thus obtained may be tested with any of the tests mentioned. If sufficient material is present to allow of filtration of the liquid resulting from maceration, this may be done. If the stain is due to iron-rust alone, this will be separated by filtration, and the liquid will pass through colourless. If we now digest the brown undissolved residue left on the filter in hydrochloric acid, free from iron, we shall obtain a yellowish solution, which will give with ferrocyanide of potassium a blue colour—Prussian blue. By this process blood was readily detected on a rusty knife used in an act of murder committed ten years previously (*Case of Gardner*), although no blood could be seen on the blade with the aid of a lens.

Red Dye Mistaken for Blood. A man was suspected of murder, and on the collar and upper part of the shirt there was a large and somewhat deep pinkish red stain, in some respects resembling washed blood. This appeared to be an unusual situation for blood, and upon testing the stained linen the stain was proved not to be due to soluble blood. On enquiry it was ascertained that the man had worn round his neck a common red handkerchief during a wet night, and while taking violent exercise. The reddish-coloured stain was thus accounted for. There were, however, some other marks on the shirt which required examination, as there was a very strong suspicion against this man. These were on the sleeves, at those parts which would be likely to receive stains of blood if they had been rolled or turned up at the wrists; and it was ascertained that the murderer in this case had used a quantity of yellow soap in washing his hands. These stains were of a brownish colour, and so far as external characters were concerned, it was difficult to say whether they had been produced by blood or not. On examining the parts of the shirt corresponding to the armpits, stains precisely similar were there seen, evidently resulting from cutaneous perspiration. Strips of linen from the stained portions of the sleeves were digested in water. In twenty-four hours the stains were entirely removed, and the water in each tube had acquired a straw-yellow colour. The solution was wholly unlike that produced by blood in any circumstances; it was not changed in colour by ammonia, or by a heat of 212° F.; but it acquired a faint opalescence on the addition of nitric acid. These results not only indicated the absence of blood, but showed that the stains were due to perspiration. The stains on the parts corresponding to the armpits could not be ascribed to blood, and from the similarity in physical and chemical properties it was impossible to attribute those on the sleeves to blood. The man was also acquitted on an *alibi*.

As regards the corroboration of these chemical tests which the microscopical examination can offer, it may be said that if red corpuscles *are* found in sufficiently fresh and natural condition to be certainly recognised, there can be no doubt that the liquid is blood. Such evidence can, however, be safely received only from one who has been accustomed to the use of the microscope and to the examination of blood. The same remark may be made about the recognition of blood crystals, with this addition, that these crystals may under the microscope be examined spectroscopically for corroboration. Negatively there is this to be said, that none of the red fluids which might be mistaken for blood owe their colour to particles in suspension in any way resembling corpuscles, and heat applied to such a solution soon shows whether the colour is due to free hæmoglobin or not.

The spectroscope should be used as a routine test.

There can be no doubt that in the hands of a competent person, this optical method will enable the minutest traces of blood to be recognised, provided any red colouring matter remains. Thus Sorby states that a spot of blood one-tenth of an inch in diameter, or a quantity of the red colouring matter amounting to the 1,000th part of a grain, is sufficient to give conclusive evidence of its presence by spectrum analysis. Sorby thus detected blood on the rusty blade of a knife with which the murder of Mrs. Gardner was committed in 1862 after the lapse of ten years. Blood stains which have been washed in water, and blood which has even been boiled or heated to 212° F., may be thus detected. In the latter case, ammonia with the aid of a gentle heat should be employed to dissolve the matters rendered insoluble by boiling. As a corroborative process it furnishes most valuable and trustworthy evidence.

The question here arises, "Are there no objections to this optical test? Are there no red colours which, when traversed by light sent through a prism, will produce absorption bands similar to those of blood?" A decoction of cochineal with ammonia has been said to possess similar optical properties, but in this liquid one broad black band obliterates entirely the yellow and orange rays of the spectrum. A solution of alkanet in alum gives two absorption-bands which might be mistaken for those of blood, but there is a third band at the end of the green rays where joining the blue. There are many dyes which give absorption spectra which resemble one or other of the derivatives of hæmoglobin. There is no pigment, however, which gives the different spectra with different reagents. The matter may be summed up as follows: that, although many substances may give absorption bands closely resembling one of the many sets of bands produced by blood, there is no known substance which will change its bands by the simple process of alternately shaking up with air and allowing the solution to settle with an added deoxidising agent, nor is there any other substance which reacts in the same way to strong acids and alkalies.

There is no difficulty in answering the question, "Does this stain show the presence of blood?" There are a sufficient number of definite corroborative tests to render proof complete.

2. Is it Human Blood?

When marks of blood have been detected on the dress of an accused person, it is by no means unusual for him to attribute the stains to blood from an animal which he had killed, such as a rabbit, bird, etc., or from the handling of fish. The question then arises whether we possess any *certain* means of distinguishing the blood of a human being from that of an animal.

Possibly hairs, feathers, fish-scales, etc., imbedded in a blood stain may indicate its origin. In a few cases the situation of the stains on different and remote parts of the dress, back and front, as well as in concealed or covered parts, may show that the defence is inconsistent with the facts; but in the large majority a medical witness will be required to state whether the blood is or is not human. It has been already observed that there are no definite *chemical* differences between the blood of man and animals. The red colouring matter, the albumen, and the fibrin are the same, so far as ordinary gross chemical and spectroscopical tests are concerned. These methods of examination give us information concerning the presence or absence of the red colouring matter of blood; but they throw no light on the question whether the blood has been taken from a human being, or from an animal.

The medical jurist may determine this important point (1) possibly but rarely by the employment of the microscope, and (2) with certainty by the biological test in the majority of cases.

Microscopical Examination

We have already seen that the objects seen under the microscope are (*a*) red corpuscles, (*b*) hæmin-crystals; and each of these require discussion.

(a) *The Corpuscles.* It must be recognised that it is only recent blood, the corpuscles of which have had no opportunity of drying, which can be submitted to this test with any hope of decisive information being obtained. The reason is that we have to rely upon three characters, *viz.*, the shape, the size, and the presence or absence of a nucleus, for our decision about the origin of the blood. When blood is dried on clothing, and it is necessary to extract the corpuscles by means of a liquid of a different nature from the serum, we cannot rely on slight fractional differences in shape and size, since we cannot be sure that the corpuscles, after having been once dried, will ever acquire in a foreign liquid the exact conditions which they had in serum; and it is hopeless then to try to find a nucleus in a condition to be recognised as such.

It may, however, happen that blood submitted for analysis in a condition in which these points are capable of determination, and they must therefore be considered.

The microscope shows physical differences in reference to the shape of the blood-corpuscles in animals of different classes, and in reference to size in animals of the same class. The red cells of all mammals are circular biconcave discs excepting in the camel tribe, in which they are oval. They are all non-nucleated. The red cells of all other animals (Birds, Fish, Reptiles, etc.) are oval and all contain nuclei. In certain cyclostomes, *e.g.*, the hagfish and lamprey, the red cells are circular biconcave nucleated discs.

The microscope, therefore, enables an observer to distinguish the *fresh* blood of birds, frogs, reptiles, and fishes, from that of a human being; and this may be of great importance as evidence.

In *R.* v. *Drury*, it was suggested by the defence that the blood stains on the clothes of the accused had been caused by his having killed some chickens. The shape of the corpuscles negatived this part of the defence. In another case, the blood was alleged to be that of a fish; this was also disproved by the shape. Bennet on one occasion was called to see a patient who was alleged to be spitting florid blood. On examining the sputum with a microscope, he found that the coloured blood-corpuscles were those of a bird. On his telling the patient that she had mixed a bird's blood with the expectoration, she was astonished, and confessed that she had done so for the purpose of imposition.[1]

The chief microscopical distinction between the *blood of man and domestic animals* consists in a minute difference in the *size* of the corpuscles. This, however, is only an average difference; for the corpuscles are found of different sizes in the blood of the same animal. In making use of this criterion, it would be necessary to rely upon the size of the majority of the corpuscles seen in a given area, and under the same power of the microscope. Their size bears no relation to the size of the animal. Thus in the horse, ox, ass, cat, mouse, pig, and bat, they are, on an average, nearly of the same size; the difference is so slight as to be practically inappreciable; in these animals they are smaller than in man and in several of the mammalia. The corpuscles in man, the dog, the rabbit, and the hare are of nearly the same size. In the blood of the sheep and goat they are smaller than in most other mammalia. The size of the corpuscles bears no proportion to the age of the animal; thus in the blood of the human fœtus they are as large as in the adult. The size of the human red corpuscles varies from 6·5 μ to 8·5 μ. These measurements, however, have to be taken as an average, and the following table is only of value in indicating the average size of corpuscles of different animals.

Size 1 micron (" μ ") = 0.001 millimetre.						
Of Circular Corpuscles.				Of Elliptical Corpuscles.		
				Short Diameter.		Long Diameter.
Elephant	9.4 μ	Musk deer	2.5 μ	Llama	4.2 μ	7.5 μ
Man	7.5 ,,	Mouse	6.6 ,,	Pigeon	6.5 ,,	14.7 ,,
Monkey	7.5 ,,	Hare	7.1 ,,	Frog	16.3 ,,	23.0 ,,
Dog	7.2 ,,	Donkey	6.3 ,,	Triton	19.5 ,,	29.3 ,,
Rabbit	7.16 ,,	Pig	6.0 ,,	Proteus	35.6 ,,	58.2 ,,
Cat	6.2 ,,	Horse	5.5 ,,			
Sheep	5.0 ,,	Cow	6.3 ,,			
Goat	4.25 ,,					

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[1] "The Microscope as a Means of Diagnosis," p. 185.

(b) *Hæmoglobin and Hæmin-crystals.* These crystals, like the corpuscles, give indisputable evidence of blood, and it has been asserted that it might be possible from the characters of the crystals to determine from what species of animal, including man, the blood was derived. Such determination is, however, not practicable.

In no circumstances whatsoever should a witness give any opinion as to whether a given blood is of human origin or not without first undertaking one of the so-called biological tests for blood.

Biological Test for the Origin of Blood

The biological tests for blood have developed out of the studies of immunity and the properties of blood sera which have advanced to such a wonderful extent in recent years. As is now well known, the injection into a living animal of certain protein substances causes the formation of "antibodies" which have a highly specific action when brought into contact with the substance with which the animal was injected. Thus in 1897 Kraus showed that if an animal is injected with a suspension of cholera vibrios the serum acquires the property of producing a precipitate when it is brought in contact with a clear extract of cholera vibrios, the reaction being in a high degree specific. Such a serum is said to contain a "precipitin." In 1899 Tchistovitch and Bordet showed that a precipitating serum could be readily produced by injecting animals with the most varied proteins or protein-containing substances such as blood, serum, milk, etc. In a long series of experiments from 1901 onwards Uhlenhuth elaborated the technique and showed that the precipitin reaction is excessively delicate in that a serum may react with a dilution of the protein as small as 1 : 100,000, and he it was who worked out the method as a medico-legal test which has now become firmly established as the "precipitin test." Nuttall carried out a total of 16,000 experiments on the blood of 586 different species of animal, and arrived at the conclusion that in the highest dilutions the test is specific. It is essential that the test should be carried out by an expert in such matters, and it is now accepted that by it the origin of the blood can be determined with certainty. As pointed out, the precipitate can be obtained with infinitesimal quantities of serum or blood which need not even be fresh. Strictly speaking, the test is not a "blood test" but a specific protein test, so that proof of the presence of blood must first be established. From a forensic standpoint, therefore, the biological test involves :—

1. The demonstration of blood.
2. The demonstration of the origin of blood.

The demonstration of blood must first be carried out by means of the tests enumerated above (benzidine test, hæmin-crystals, spectroscopic, etc.), after which the source of the blood (human or otherwise) is ascertained by the precipitin test.

The Preparation of Anti-sera[1]

The production of anti-sera is carried out by the injection of rabbits with the sera of different animals as required. For example, if it is required to obtain an anti-serum for human blood, the operator obtains a supply of human serum in an aseptic state either from the mortuary or, better, by collecting it from the freshly cut umbilical cord of a new-born baby. Coagulation is allowed to occur, and the clear serum is pipetted off into tubes, which are hermetically sealed and kept in an ice chest until required.

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[1] For details of the technique mentioned in these tests, consult "Recent Advances in Forensic Medicine," Sydney Smith & Glaister, Churchill, 2nd Edit.; or Sutherland, "The Examination of Blood Stains."

The experimental animal, a rabbit for preference, is then prepared for the injection by clipping the ear fur and disinfecting the ear with ether. Intravenous injection into the marginal vein of the ear is the most efficacious and economical method.

The dose should not exceed 1.5 to 2 c.c. per kilogramme of the rabbit's weight. The dose is repeated every third day for three to five injections. Tests are made to obtain the titre of the rabbit's anti-serum by titrating a few drops against known dilutions of human serum. If a quick reaction with anything over 1 to 1,000 is obtained the animal should be bled by direct aspiration from the heart or by cutting its throat over a sterile dish (the skin surface having been first rendered aseptic by shaving and disinfection). After the blood clots the clear serum is pipetted off into 1 c.c. tubes and hermetically sealed. If kept in an ice chest, these sera keep active for years. Many investigators prefer combined intravenous and intraperitoneal injections of serum. A dose of 1 to 2 c.c. is given intravenously and repeated after five to six days. This is followed by the injection of 5 c.c. intraperitoneally at intervals of four to five days for about three doses. The serum of the animal is titrated after each injection and when the anti-serum is sufficiently strong the animal is bled to death.

The Test. All sera must be carefully examined before starting the test. A few drops of the anti-serum are added to a c.c. of normal saline, and if no cloudiness appears within half an hour it may be considered satisfactory. It is then tested for potency by adding a few drops to a solution of 1 in 10,000 of related serum and should give a cloudiness within half an hour. It is then tested for specificity by addition to similar solutions of non-related bloods and should show no sign of cloudiness. A solution of the suspected stain is prepared by moistening a portion of the stained cloth or fragment taken from a stained object with normal saline in a covered watch-glass or glass pot and placing the preparation in an ice chest overnight.

In the morning the pot is tilted on one side in order to allow the fluid to separate. The preparation is not shaken or manipulated more than is necessary, or otherwise a turbid solution may be the result.

If the solution is cloudy a fresh preparation should be made before attempting to clear the solution by filtering, or by other means. If it remains persistently turbid it must be filtered.

The solution should be neutral and if found to be either acid or alkaline it should be neutralised by the use of a dilute solution of tartaric acid or of sodium hydroxide. A few drops of the clear solution are then run into a test tube and a few drops of anti-serum carefully run down the side so that no mixing occurs : the anti-serum runs to the bottom of the tube and a clean-cut line of demarcation can be seen between the two solutions. The tube is then placed in a rack in front of a window or in a special viewing box. In any case, light must be allowed to fall on the tube obliquely from above or below so that dispersion takes place at the junction of the two liquids. Within a few minutes a haziness appears at the junction and soon forms a definite ring if the test is positive.

A series of controls must now be set up, consisting of diluted samples of the stain, 1–500 to 1 in 10,000 approximately, a solution from an unstained part of the garment or other object, normal saline, a solution of rabbit serum, solutions of pure blood of man, ox, sheep, bird, or others as may be necessary, to each of which a few drops of human anti-serum is added.

A sample of rabbit serum is tested with a solution of the stain.

If the stain is of human origin it should give a ring of precipitation successively less with the dilutions of the stain extract, a positive result with the human blood serum and with none of the others.

The test may also be carried out in capillary tubes. A quantity of freshly drawn, clear capillary tubes is prepared. A series of drops of human anti-serum is then placed on a white tile. A small quantity of the stain extract is then run into a capillary tube, followed by an equal amount of human anti-serum from one of the drops. Both solutions pass up the tube by capillary attraction.

The tubes are observed against a dark background, the top of the tube being tilted away slightly from the observer. If the stain contains human blood and the anti-serum is potent, a ring precipitate appears at the line of junction of the two liquids within a few minutes. The stain extract is then tried against a series of anti-sera (ox, sheep, bird, etc.) and against normal rabbit serum; the human anti-serum is tried against known human serum, sera of certain other animals, and against normal saline for controls, and an unstained portion of the exhibit is extracted and tested against the human anti-serum. If the solution of the suspected stain gives a position reaction with the human anti-serum, and with nothing else, the stain contains human albumen. If no reaction is obtained with the human anti-serum, the reverse is not necessarily the case, for blood in certain conditions, and from the action of certain chemical substances, loses its quality of precipitation.

Before a negative can be proved the stain must be shown to react with some other anti-serum.

It was at one time thought that the precipitin reaction was rigidly specific, but later work, particularly by Nuttall, has shown that, although there is a very definite species specificity, this is not so rigid as was supposed.

Although a maximum reaction is always given by the homologous blood (that is, by the blood of the animal which supplied the blood injections of the rabbit), it is possible to get minor reactions with the blood of nearly related animals. For example, human anti-serum gives a maximum reaction with human blood, but it gives a good, though less, reaction with the higher apes and a slight reaction with monkey's blood. Horse anti-serum gives almost equal reactions with horse, mule and donkey blood. Serum prepared against pigeon blood reacts with most other birds. Ox anti-serum gives a reaction with ox, sheep and goat blood. By suitable dilution of the stain extract a point is reached where the anti-serum loses its group precipitins and becomes specific. In practice, the group precipitins are of little importance; for example, when the stain is alleged to be due to human blood the statement that it was caused by the blood of an anthropoid ape would require corroboration which would be difficult to obtain.

On the other hand, there may be a real difficulty when the question lies between two animals, such as the sheep and the goat, in cases of theft or of maiming. We have had numbers of such cases to deal with, and find that by dilution of the stain and making successive experiments with titred anti-sera of both animals a decisive result may readily be obtained.

Uhlenhuth got over the difficulty by cross-immunisation. On one occasion he had to test a stain for hare's blood. He injected a rabbit and also a fowl with the blood of this animal, and found that, whereas the anti-serum from the rabbit was rigidly specific for hare's blood, the anti-serum from the fowl reacted with both rabbit's and hare's blood. He followed this up by injecting monkeys with human blood, and obtained a serum which reacted with human blood only, and gave no reaction with monkey's blood.

Landsteiner[1] finds that species differentiation is more distinct in the corpuscles than in the serum. Agglutination tests with the removal of non-specific agglutinins by saturation show differences between human and anthropoid blood and between different genera of monkeys in cases where precipitin tests fail.

The precipitin reaction has also been used for the recognition of fragments of flesh, bones, etc., the origin of which could not otherwise be determined. On several occasions we have had to ascertain whether a small portion of tissue could have been human by this test, and have used it in detecting albumen of different animals in many fabrications. Space does not permit a description of many interesting features about this test, but the reader may obtain full details in Sutherland's " Blood-stains," where a description may also be obtained of the agglutination test, the complement deviation test, and the anaphylactic test, which will not be considered here. There is also an exhaustive account of the test in Smith and Glaister's " Recent Advances in Forensic Medicine," and Nuttall, " Blood Immunity and Blood Relationship " (Cambs.), 1904.

3. Age of Stains

This is a question which may be of vital importance. The answer to it depends upon the fact that when once blood has been shed and exposed to atmospheric and other influences its hæmoglobin is converted into methæmoglobin and hæmatin. These changes are well known and understood, but it is not clearly defined at what rate they take place under the varying influences to which the blood may be exposed, nor the time requisite for the total conversion. The more acid there is in the air the more rapidly is the change produced, but it is impossible to say that this is the only atmospheric impurity that can effect the change, nor is it possible to state the amount of the acidity in the particular air to which any given stain was exposed. The physical change in a stain produced by these chemical processes is a colour change from red to reddish brown ; hence, supposing the stuff to be white or nearly colourless, the spot of blood if *recent* is of a red colour ; but sooner or later it becomes of a reddish brown or of a deep red-brown colour. The change of colour to a reddish brown may take place in warm weather in less than twenty-four hours. After a period of five or six days, it is scarcely possible to determine even conjecturally the date of a stain from its appearance. In a large stain of blood on linen, no further obvious change took place during a period of fifteen years. It had a reddish brown colour at the end of six weeks, which it retained for the long period mentioned. The stain may not be so readily dissolved by water, but no chemical test applied to the solution can enable a chemist to fix the date. Blood of one week's and blood of six weeks' date may present the same chemical properties and physical characters.

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[1] *Jour. Exp. Med.*, December, 1925.

Spectroscopic examination does not take us much further. It will show the presence of oxy-, or reduced, hæmoglobin, methæmoglobin, or hæmatin, but this is immaterial beyond the bare fact that we are not dealing with absolutely fresh blood if the spectra of methæmoglobin or hæmatin are present without preliminary treatment. Heat also affects the appearance of a blood stain. Blood dried in a pure atmosphere and kept from air may retain its chemical character of freshness for a long time. It is possible that the rapidity with which the red colouring matter dissolves in water and other liquids may constitute a basis for a medical opinion. It has been long known that the fresher the blood the more easily is the red colour imparted to water ; hence the suggestion that the age of the stain on linen and other stuffs might be fixed by the time required for the commencement and completion of the solution of the red colouring matter. The solvent employed is a solution of arsenious acid in distilled water, in the proportion of one grain to two drachms of water This is a good solvent for the red colouring matter. In examining stains on linen and other stuffs, the rapidity of solution must, however, depend on so many contingencies irrespective of age, for example ; the quantity of the blood, the nature of the stuff, its thickness, and its permeability to liquid, that no definite rulescan be safely laid down for determining the precise date.

4. Is the Blood Arterial, Venous, Menstrual, Man's, Woman's, Child's ?

It is not possible to distinguish *arterial* from *venous* blood by any physical or chemical characters when it is in a dry state upon articles of dress, furniture, or weapons ; but this, in medico-legal practice, is not often a subject of much importance, since there are few cases of severe wounds, either in the throat or other parts of the body, in which the two kinds of blood do not escape simultaneously. The most striking and apparent difference between them, when recently effused, is the *colour*, arterial blood being of a bright scarlet, while venous blood is of a dark red hue ; but it is well known that the latter, when exposed to air for a short time, acquires a florid red or arterial colour ; and the two kinds of blood when dried cannot be distinguished chemically by any known test.

With regard to the rest of our present question we may say that there is no method yet known by which the blood of a man can be distinguished from that of a woman, although the presence of sex hormones in the blood may lead to the differentiation of the blood of the two sexes in the near future. The blood of a child at birth forms a thinner and softer coagulum than that of an adult, and in the new-born many of the red corpuscles are nucleated and exhibit greater fragility. There is a difference in structure between fœtal and maternal hæmoglobin which enables an exchange of oxygen to occur in the placenta but this difference is not detectable chemically.

A medico-legal question has arisen, on more than one occasion, as to whether there are any means of distinguishing *menstrual* blood from that of the body generally. The only differences noticed are of an accidental kind: (1) that it may be acid (fresh blood is alkaline), owing to its admixture with vaginal mucus; (2) that under the microscope it may be mixed with epithelial scales, which it has derived from the mucous membrane in its passage through the vagina; and (3) it contains, as a general rule, large numbers of micro-organisms, whereas in an ordinary blood stain which has dried quickly there are few to be found. In the wombs of women who have died suddenly while menstruating, coagulated blood has been found. If, therefore, menstrual blood does not coagulate, it is simply because it has already coagulated within the uterine cavity, and cannot do so again; it is more fluid than ordinary blood, because, during its trickling descent, it becomes mixed with watery uterine and vaginal mucus.

5. Did it come from a Living or Dead Body?

It is well known that blood in the act of dying produces a clot of fibrin, and the only two possible chances of answering the above question are (*a*) the discovery of this fibrin; (*b*) noticing the physical characters of the spots of blood.

With regard to the first point, it must be noted that chyle and lymph also possess the property of coagulation with the production of fibrin. Hence evidence must first be obtained of the existence of hæmoglobin in a stain. Supposing this to have been done, and further that the hæmoglobin has been completely abstracted, and a small quantity of fibrin has been left behind as insoluble, these fibrils of fibrin must be identified as such, a by no means easy task, and even then all that can be said is that the blood came from either a living person or from one who had been dead something under three or four hours, the time, *i.e.*, in which the blood left in the vessels commences to coagulate. *Per contra*, if the quantity of blood examined be comparatively great, and no fibrin can be procured from it after complete digestion in cold water, it is probable that this blood has not come from a living body, and that it is merely a mixture of red colouring matter and serum, like that found in the vessels of the dead body after coagulation.

With regard to the second point, it is alleged that the fact of the blood having come from the arteries of a living person will be indicated by its being scattered in drops (from the spurting of an artery) over surfaces upon which it has fallen, while the venous blood is always poured out in a continuous, not jerky, stream. These differences are constantly observable in every operating theatre. In most wounds which prove fatal by hæmorrhage, the blood is poured out simultaneously from arteries and veins. The sprinkled appearance of the blood, when it exists, will, *cæteris paribus*, create a presumption that it was poured out from a *living* body, for after the heart has ceased to act the arteries lose the power of throwing out the blood in jets. It must be remembered, however, that blood projected with force by swinging a blood-covered weapon or by any other means will produce a similar appearance.

This method of distinguishing the two kinds of blood, therefore, may only occasionally be available for practical purposes; it must also be remembered that accident may lead to the sprinkling of blood from a small vein which has been wounded, while blood may be poured out in considerable quantity from an artery, especially if large; and if it falls on one spot at a short distance, it may produce a soaked appearance. The sprinkling may be expected only when the wounded artery is small, and the blood is shot to a distance. This is a fact which a medical jurist should not overlook, although, for the reasons stated, too great a reliance must not be placed on it. The spots of blood, if thrown out from a living blood vessel, speedily consolidate, and the fibrin, with the greater portion of the colouring matter, is found of a deep red colour at the lower part of the spot, the upper portion being of a pale red. The lower and thicker part has commonly a shining lustre, as if gummed, when the spot is recent, and when it has been effused upon a non-absorbent surface. In *R.* v. *Spicer* there was a wound of the temporal artery of the deceased woman. A brick in the wall, opposite to the spot where the wound was inflicted, was thus sprinkled.

This question arose in 1909 at the trial of a woman at Salisbury who was accused of the murder of her crippled son. Professor Pepper swore that on the sleeves of the blouse which she was wearing at the time of the assault were spots of blood which could not possibly have come there as a result of having a blood-stained knife thrown at her, but were from a small severed artery. The jury disagreed on the first trial; at the second trial she was acquitted even in the face of this evidence.

The size and direction of the spots vary according to the distance of the person wounded and the direction in which the spurting has taken place against the surface. When blood falls upon porous articles of clothing, as linen or cotton, it is absorbed, and produces a dull stain. In dark-coloured articles of dress it is sometimes difficult by daylight to perceive these stains, which may be more perceptible when seen by reflected light.

6. Did the Blood come from Victim or Assailant ? [1]

It is not possible to identify the individual sources of a blood stain at the present time, but if the victim and assailant are in different blood groups it should be possible to differentiate between the two bloods as is described below. In certain extraordinary circumstances in which there is disease of the blood in one or the other, it is possible that information of value might be obtained, and in certain instances a test for a particular disease might be carried out.

The side of a garment on which the blood has been shed and coagulated may give a clue if it can be positively determined that the inside of a garment worn by the deceased was the side upon which the blood was shed. This is, so far as it goes, suggestive that the blood came from the victim, and the assailant is suggested if the outside is chiefly stained; but it is very easy to imagine conditions of the dress in which even these slight suggestions would cease to have any value.

Large pools of blood near a body which has had a large vessel wounded and has bled to death are again strong presumptive evidence in favour of their origin from the victim.

7. Blood Grouping and its Medical-Legal Applications.

All human beings are divided into four principal blood groups. This follows from the fact that when the red blood corpuscles are suspended in their own serum, or serum from a similar group, there is an even suspension. If, on the other hand, they are suspended in a serum of a different blood group, they eventually collect together in clumps. This phenomenon of clumping is known as agglutination, which is due to certain substances present in both the red corpuscles and the blood serum. The red corpuscles contain what is known as the agglutinogens (antigens), and the serum contains the agglutinins or anti-bodies.

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[1] See also p. 336, Blood Stains in Room; p. 340, Blood Stains on Weapons; p. 342, Blood Stains on Assailant.

Agglutination in the blood of humans was first noted by Landsteiner in 1900. He and his colleagues classified blood into four groups, now called A, B, AB and O. Such groups are known as the ABO groups, and have been so named because it was shown that there were two agglutinogens or agglutinable substances, A and B, in the corpuscles, and two agglutinins, *a* and *b*, in the serum. These substances are disposed as follows in the four named groups :

GROUP			SERUM	CORPUSCLES
Jansky	Moss	International		
I	IV	O	Agglutinins *a* & *b*	No agglutinable substances
II	II	A	Agglutinin *b*	Agglutinogen A
III	III	B	Agglutinin *a*	Agglutinogen B
IV	I	AB	NO agglutinins	Agglutinogens A & B

The agglutinin *a* agglutinates only corpuscles containing the agglutinable substance, or agglutinogen A, and the agglutinin *b* only corpuscles containing the agglutinogen B. It follows, therefore, that the serum of Group AB persons will not agglutinate corpuscles from any group. The serum of Group A agglutinates corpuscles of Group B ; the serum of Group B agglutinates corpuscles of Group A ; the serum of Group O agglutinates the corpuscles of Groups A, B, and AB.

Conversely, Group AB cells are agglutinated by the sera of Groups A, B and O ; Group A cells are agglutinated by the serum of Group B ; Group B cells are agglutinated by the serum of Group A ; Group O cells are not agglutinated by any sera.

It must be mentioned that the above groups have two different numerical classifications, which have been freely used in the past. Jansky (1907) and Moss (1910) applied the numbers I, II, III, and IV to groups, as will be seen from the above table. These numerical classifications are much to be deprecated, and should never be used, since the figures I and IV in each classification apply to different groups and thus lead to much confusion, mistakes being easily made. The alphabetical or International Nomenclature, apart from preventing confusion, gives information about the groups, and in its medico-legal applications the heredity of the blood properties is presented more directly.

With regard to Group A, it was first demonstrated by Dungern and Hirschfeld (1911) that there are two sub-groups, namely A_1 and A_2. These are also found in Group AB, giving rise to sub-groups A_1B and A_2B. The red corpuscles of sub-group A_1 absorb agglutinin *a* more completely than do those of A_2. The serum of Group B blood contains agglutinins *a* and a_1 respectively, and by absorbing this serum with A_2

cells, a_1 is obtained free from a. The agglutinin a agglutinates A_1, A_2, A_1B, and A_2B cells, whilst that of a^1 only reacts with the sub-groups A_1 and A_1B. More weakly reacting sub-groups A_3, A_4 and A_5 are known to exist, but are very rare. A_3 is perhaps found in one out of 2,000 persons, and one example of A_4 was found in 60,000 routine examinations.

In the United Kingdon the approximate proportions of the above groups and sub-groups are believed to be as indicated below :—

Group	O	A	B	AB	A_1	A_2	A_1B	A_2B
Percentage ..	46	42	9	3	35	10	2·5	0·5

In addition to the above A_1A_2BO blood groups, but entirely distinct and having no relation whatever with them, are three blood types known as the MN types. Landsteiner and Levine (1928) demonstrated that human blood can be divided into types M, N and MN. In type M the corpuscles possess the agglutinogen M, but no N ; in type N the agglutinogen N is present but no M ; in type MN the blood possess both the agglutinogens M and N. No blood lacking both agglutinogens has been found, and the agglutinins anti-M and anti-N do not occur naturally in human serum.

There is yet another more recently discovered factor known as the Rh factor, or Rh agglutinogen or antigen, which is present in the red blood corpuscles of certain humans and absent in the case of others. Landsteiner and Weiner (1940) found that when rhesus (monkey) red blood corpuscles were injected into rabbits or guinea-pigs an immune serum was produced, with which an agglutinable substance in human blood was detected. This substance was different from A, B, M or N. Consequently it was designated Rh, showing the use of rhesus in producing the serum. The anti-Rh agglutinin produced in the rabbit's serum by the injection of the rhesus red blood corpuscles agglutinates the blood corpuscles of about 85 per cent. of human beings, these people being known as Rh-positive. Their corpuscles will always be agglutinated by any sera containing anti-Rh agglutinin. The red blood corpuscles of the remaining 15 per cent. of humans are not agglutinated by this type of serum, and such people are known as Rh-negative, their red blood corpuscles having no Rh antigen. Rh is present at birth and is distributed evenly amongst the two sexes.

This factor has an important practical bearing on the etiology of hæmolytic disease of the new-born and in the results of a certain number of cases where transfusion has been carried out.

When Rh-positive blood is tranfused into an Rh-negative individual, that individual will produce anti-Rh agglutinin in his or her serum. Consequently, when a second transfusion from an Rh-positive donor is given at a later date, hæmolysis may occur, with unhappy results to the patient. An Rh-negative mother may receive Rh antigen from the fœtus through the placenta when the child is Rh-positive, the father having been Rh-positive. This Rh antigen produces Rh antibodies in the mother, who may thus develop hæmolytic reactions if transfused after the birth of the child with Rh-positive blood. Again, this anti-Rh agglutinin may pass from the mother by way of the placenta into the fœtus which is Rh positive, and so the child will develop erythroblastosis fœtalis, or hæmolytic disease of the new-born.

The Rh factor has also a number of sub-types, some of which are very rare. It is a factor which may be considered in cases of disputed paternity.

Blood-Grouping. Apart from their importance in transfusion, the blood groups play an important part in medico-legal investigations concerning the identity of blood stains, certain body fluids, and in cases of disputed paternity.

With regard to stains, it may be necessary to try to prove whether the blood could have come from the accused or from the injured or murdered individual. If it can be shown that blood stains found in relation to the accused are of a different group from that of the blood of the injured or deceased person, then a positive answer can be given ; whereas, if they are of a similar group, then this at the most can only be corroborative circumstantial evidence.

Blood stains are usually dry when they reach the laboratory, but, if they happen to be still moist, a piece of stain may be soaked in normal saline solution and the red blood corpusles obtained in the soak can be tested with A and B sera. When the stain is perfectly dry, however, it is impossible to obtain corpuscles in a sufficiently good state to show agglutination, and therefore, different methods have to be adopted.

In the first place, an attempt may be made to identify the agglutinins in the stain. If a crust can be obtained, the method of Lattes may be used. Small pieces of the crust are placed on three microscope slides and to these is added a drop of cell suspension in normal saline of known A, B and O bloods respectively. A cover glass is placed over each preparation, which is left for 30 minutes in a moist chamber. They are examined under the low power of a microscope, and when a positive result is obtained, clumping of the corpuscles round the immediate vicinity of the crust will be seen. During the 30 minutes' interval it may be necessary to manipulate the cover glass with light pressure. Group O blood is used as control, as at no time should there be agglutination of these cells.

If the material is saturated with blood an extract may be made of it. A portion of the stained material is soaked in a very small quantity of distilled water or weak saline, being compressed from time to time with a glass rod or forceps. It should be left for an hour at room temperature, and then placed in the refrigerator overnight. It may be necessary to centrifuge the expressed liquid, which is then tested against A, B and O cells. Positive results only can be considered, as in a negative result it is possible that the agglutinin has deteriorated. For example, if A cells only are clumped and not B cells, the blood may be that of Groups B or O, but certainly not A or AB, since in O the *b* agglutinin may have deteriorated. If both A and B cells are agglutinated, but not O cells, then there is no doubt that the blood belongs to Group O. Controls of the material should always be used in the above tests in order to eliminate the possibility of the presence of any substance, apart from the agglutinins, which might agglutinate red blood corpuscles.

A more reliable method of obtaining the group of a stain is that of absorbing the agglutinins in known sera by the agglutinogens which are present in the stain. In practice, the stain is frequently too small to allow for a satisfactory amount of agglutinin to be obtained from it. Again, the agglutinins deteriorate more rapidly than the agglutinogens, which, however, may, by prolonged drying, lose their capacity to absorb group agglutinins. Thus, when a stain fails to absorb an agglutinin, it does not always mean that the agglutinogen is absent; it may be inactive. On the other hand, there may be substances in the material on which the stain is present, such as body fluids, which contain group-specific substances which tend to mask the correct determination of the agglutinogen content of the blood stain. Other substances, apart from body-fluids, such as certain dyes, disinfectants, scents, etc., may also do this. Hence the very greatest importance must be attached to rigorous controls of the unstained material itself, taken from as near the stain as possible. This on no account must ever be omitted. It is useless to attempt this method without having access to control material.

The testing sera should be those of Groups A and B. Group O serum has been recommended, but it is not always so satisfactory because the titre of the two agglutinins is often unequal. Also, it may be that, when one agglutinin is removed, this may involve some removal of the other. If there is only sufficient stain for one absorption, equal quantities of sera A and B should be used.

Each serum must be tested beforehand to prove its reliability and strength. A 1 in 2 or 1 in 3 dilution in normal saline should be used, and this further diluted by making progressively doubled dilutions. In the case of a 1 in 3 dilution the ultimate dilution should be 1 in 384. Each dilution is tested separately under the same conditions in which the absorbed sera are to be used. As the quantity of stain available for testing is frequently limited, the tests can be carried out in " well " microscope slides. A^1, A^2 and B corpuscles should be used routinely throughout the test. The dilutions are made by means of drops from a capillary pipette, and, after they have been thoroughly mixed, an equal drop of the appropriate cell suspension in normal saline is added to each. After 30 minutes, during which the slides have been thoroughly shaken, the readings are taken through a low-powered microscope.

Both the sera having been thus tested, a small quantity of each (1 in 2 or 1 in 3 dilution) is added to separate portions of the stained material in small test tubes. Care must be taken that a sufficient quantity, not too much or too small in amount, is used. It is sufficient if four drops of the absorbed A serum, and five drops of the absorbed B serum, can be drawn off for the carrying out of the test. In the case of the stain itself, it is occasionally possible to scrape sufficient off the surface of the material. If the blood is well soaked into the cloth, the cloth should be cut into small pieces before soaking with serum. After thorough mixing, the test tubes are left at room temperature for an hour and then placed in a refrigerator overnight. The treated sera should again be left at room temperature for an hour before testing. It may also be necessary to centrifuge them. The depth of colour of the absorbed serum should also be observed, as this may assist in assessing the final results. Pieces of unstained material of similar size to the stained must also be put up in exactly the same way for control purposes. Finally, all the sera from the stained and unstained material should be titrated in dilutions up to 1 in 384 against A^1, A^2 and B cells, as has been described for the preliminary testing of the sera. If sufficient stain is available, the results from the use of human sera of Groups A and B may be checked by the use of absorbed immune anti-A and anti-B sera. This also makes the detection of A^2 stains easier.

There may be incomplete absorption owing to an insufficiency of the stain. The reduction of the agglutinin titre must be at least three places with regard to the *a* agglutinin, and two in the case of the *b*, before any significance can be attached to the readings. If there is a failure to absorb both the agglutinins, it does not necessarily mean that the blood belongs to Group O. There may not be sufficient blood present, or the agglutinogens may have deteriorated. An attempt should be made to obtain the agglutinins, as even if one, such as the *a*, only is detected, then these findings are practically diagnostic of Group O.

The presence or absence of the agglutinogens M and N has been demonstrated in dried blood several weeks old, but at present it may be said that M is the only factor which can be reliably dealt with. The absorption method is used for its detection, and also test cell suspensions of M, N and MN groups taken from Group O individuals.

Stains other than Blood. Body tissues and secretions also contain group substances. Those found in seminal stains and saliva may be of considerable importance in medico-legal work. However, it must be remembered that not all individuals have these group substances in their semen or saliva, and individuals are known as "secretors" or "non-secretors," according to whether or not the group substances are naturally present. In the case of "secretors" the group can usually be readily established, as the group-specific substances occur in relatively high concentration, but of course in "non-secretors" they are absent. The absorption method, similar to that described for blood stains, is used, with similar rigid controls. When no absorption is found to occur, it has to be assumed that the material belongs to Group O, or that the individual is a "non-secretor," or that there has been deterioration of the group substance. It may in such cases be possible to verify this by ascertaining the blood group of the suspected person.

Nasal mucous stains also contain a large amount of group substance. Urine and sweat stains have a low group substance content and a high salt content. Because of this they may give non-specific reactions.

The above facts have to be remembered when one specific type of stain is apt to be contaminated by another. For example, blood from an assaulted individual may be contaminated by seminal fluid from the assailant. Blood or seminal stains on a handkerchief may be contaminated by nasal mucous. Sweat on garments which have been worn close to the body, or urine, may be a source of contamination. Consequently, the results of the groupings of such contaminated stains may be quite worthless.

Blood Groups and Heredity. The ABO groups are hereditary factors, being inherited according to Mendelian principles. One of each of the antigens A, B or O is passed on to the child by each parent. O is now recognised as being not merely an absence of A and B, but is known to be a weak antigen. These factors are carried in "genes" which are present in the rod-like bodies, or chromosomes, which occur in pairs (there being 24 pairs) in the nucleus of every cell apart from the reproductive cells. In these reproductive cells (sperm and ovum) the pairs of chromosomes separate, so that the sperm from the male contains only one of each kind of chromosome (in all, 24 chromosomes) as does also the ovum of the female. When these cells unite in reproduction, the pairs are again established, one of each pair having been received from either parent. The human blood groups are inherited by such a mechanism. Bernstein (1924) showed that the three genes A, B and O form a series of triple allelomorphs, and his suggested mechanism of inheritance is now accepted as correct.

A and B are both " dominant " to O, and O is " recessive " to A and B, whilst A and B are equally dominant. One of each of these factors must be contributed by the parent, so that the genetic constitution of the offspring may be AA, AB, AO, BB, BO or OO. This is known as the genotype. AA, the homozygote, cannot be serologically differentiated from AO, the heterozygote, and the same occurs with the genotypes, BB and BO, the serologically demonstrable blood group (phenotype) in each case being A and B. In addition, of course, there are the phenotypes AB and O.

If either of the factors A and B is present in the child's blood, it must have been present in the blood of at least one of its parents. Thus :

(1) Unions of Groups O and O parents beget O children.
(2) Unions of Groups O and A parents beget O or A children.
(3) Unions of Groups O and B parents beget O or B children.
(4) Unions of Groups A and A parents beget O or A children.
(5) Unions of Groups A and B parents beget O, A, B or AB children.
(6) Unions of Groups A and AB parents beget A, B or AB children.
(7) Unions of Groups B and B parents beget O or B children.
(8) Unions of Groups B and AB parents beget A, B or AB children.
(9) Unions of Groups AB and AB parents beget A, B or AB children.
(10) Unions of Groups AB and O parents beget A or B children.

It will also be noticed that a child of Group O cannot come from a father or mother of Group AB, and that a child of Group AB cannot arise from a union in which one parent is in Group O.

The sub-groups A_1 and A_2 are also inherited, and can be explained by an extension of Bernstein's theory. A_1 and A_2 are dominant to O, whilst A_1 is dominant to A_2. A_1 or A_1B children must have one or both parents belonging to one of these sub-groups, and A_2 children cannot have A_1B parents, nor can A_2 parents have A_1B children.

The factors M and N are inherited in the same way, being of course, entirely independent of the ABO grouping. Moreover, an individual must have one or other or both of the factors M and N ; he can never have *neither*, there being nothing which corresponds to O. Both are of equal dominance. Each parent supplies a factor. When both supply M, the homozygote MM results, the child belonging to the group M. When both supply the factor N, the homozygote NN results, the child belonging to Group N. When one parent supplies M and the other N, the heterozygote MN results and the child belongs to Group MN. An N child cannot come from an M parent, and vice versa, an M child cannot come from an N parent.

The Rh-factor is also inherited as a dominant character. The gene Rh determines its presence, and the gene *rh* its absence. It has the same distribution in both sexes, and appears to be quite independent of any other blood group.

The S or "secretor" factor is another factor which appears to be determined by Mendelian principles of heredity. As already mentioned, certain people secrete the antigens A and B into the saliva, semen and other body fluids, whilst others do not. The secreting type is the more common. The genes are known as "S" (secretor) and "*s*" (non-secretor). It is inadvisable to use this test when any of the persons concerned belongs to Group O.

The property P has been considered in cases of disputed parentage. Landsteiner and Levine (1927, 1928) produced sera which defined another property in human blood, which was called by them agglutinogen "P." It would appear that this factor is transmitted as a Mendelian dominant, an individual either being P+ or P−. The lack of a regular source o potent anti-sera is an obstacle in the application of this test in paternity cases.

The ABO and MN groups are most frequently used in cases of disputed parentage, although the additional factors mentioned above might be used when the opportunity presents itself. The correct diagnosis of the M and N groups requires very great experience.

With regard to the ABO groups, the agglutinogens are always present at birth, whereas the agglutinins develop in the first few months of life and are fully established at the end of two years. The M and N factors are present at birth, as is also the Rh factor. In testing a newly born child, it is probably better to wait until the child is at least one month old.

The blood grouping test in paternity cases is of use only in *excluding*, but not proving paternity. About 30 per cent. of the cases can be established as innocent. It is the only certain method of establishing innocence.

The blood grouping tests are recognised by law in various states of the U.S.A., Germany, Italy, Russia and many other countries. Within recent years, such evidence has been admitted in the English Courts, but proposed legislation has been interrupted by the outbreak of the war.

In *Wilson v. Wilson*[1] evidence was given that the husband's blood group was OM, that the wife's was BM and that the child's (whose parentage was in dispute) was ABN. The Divorce Court accepted medical evidence that the husband could not have been the father of the child and granted a decree of nullity accordingly.

For further information regarding this subject, the reader should consult the following publications:

Blood Groups and Transfusion, by A. S. Wiener, 3rd edition, 1943.
Blood Grouping Technic, by Schiff and Boyd, 1942.

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[1] *Lancet*, 1942, 1, 570.

CHAPTER XI

FIREARM WOUNDS

Wounding by firearms is dealt with under the following sections of the Offences against the Person Act, 1861 :—

Sect. 14. " *Whoever . . . shall shoot at any person or shall by drawing a trigger or in any other manner attempt to discharge any kind of loaded arms at any person . . . with intent . . . to commit murder shall, whether any bodily injury be effected or not, be guilty of felony.*"

Sect. 18. " *Whoever shall . . . by drawing a trigger or in any other manner attempt to discharge any kind of loaded arms at any person with intent . . . to maim, disfigure, or disable any person, or to do some other grievous bodily harm to any person, . . . shall be guilty of felony.*"

Sect 19. " *Any gun, pistol, or other arms which shall be loaded in the barrel with gunpowder or any other explosive substance and ball shot, slug, or other destructive material shall be deemed to be loaded arms within the meaning of this Act, although the attempt to discharge the same may fail from want of proper priming or from any other cause.*"

Sect. 28. " *Whosoever shall by the explosion of gunpowder or other explosive . . . burn . . . or do any grievous bodily harm . . . shall be guilty of felony.*"

GENERAL DESCRIPTION OF WOUNDS PRODUCED BY FIREARMS

The recognition of firearm wounds though usually easy, is sometimes extremely difficult, for many types of injury are produced which have little resemblance to the commonly accepted characters of gunshot wounds. This is particulary the case when high velocity weapons are discharged at close range, and in glancing wounds.

We should be able from an examination of the injuries to form some idea of the type of firearm and projectile that was used, the distance and direction of fire, and the number of shots that may have been fired. It is of obvious importance to ascertain whether the wound was suicidal in origin, whether it was self-inflicted for the purpose of deceit or for malingering, or whether it was accidental or homicidal in nature. We should also be familiar with the more remote effects of projectiles—effects which may not be recognisable at the time, but which, at a later period, may lead to pathological conditions and various disabilities which are of the utmost importance in claims for compensation or pensions by the injured person, or grants to surviving relatives.

In many cases extraordinary wounds are caused by normal projectiles, and for this and other reasons it is desirable that we should discuss the elementary features concerned with the production of such wounds.

The principle in all firearms is essentially the same. A charge of powder, black or smokeless as the case may be, is compressed in a cylinder. It is then ignited by percussion of a fulminating mixture in the cap. The ignition of the powder leads to the evolution of a quantity of gases at very high pressure and temperature, and the expansion of this volume of gas forces out the projectile at a greater or less velocity. All bullet-firing weapons have the barrel cut in a series of spiral lands and grooves, and the forcing of the projectile into these grooves imparts to it a spin which will vary with the velocity and the inclination of the rifling.

The structure of cartridges varies with the type of powder and projectile.

Black powder is a mixture of sulphur, saltpetre and charcoal and is found as black grains, coarse or fine as the case may be, without any particular form. Smokeless powders show great variation. They may be in the form of fine or coarse flakes, discs, cylinders, or, in the case of cordite, in longer threads like chopped string, and the shape and form may be sufficient to identify them microscopically. Although called smokeless, they emit a certain amount of smoke, but never cause the same degree of blackening which we find with black powder.

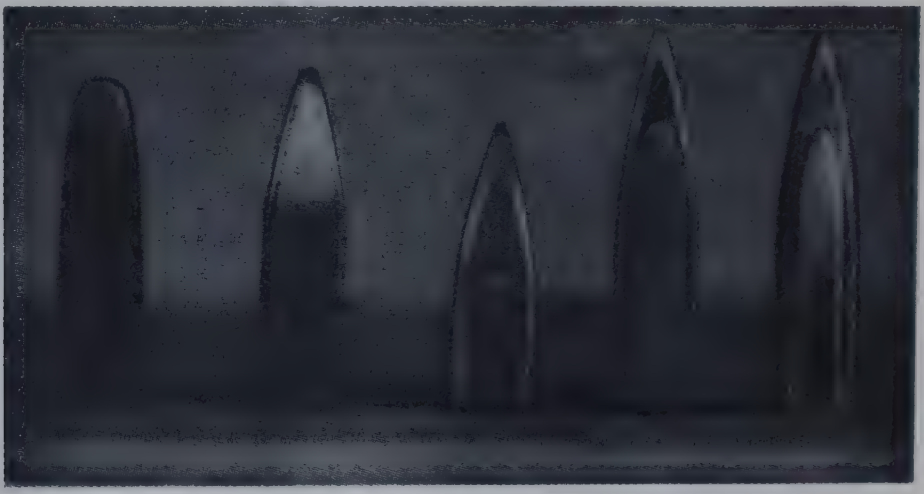


Fig. 27.

1 Mark VI British rifle bullet with lead core and cupro-nickel jacket.
2. Mark VII British rifle bullet with lead core, aluminium tip and cupro-nickel jacket.
3. German rifle bullet with lead core and soft steel jacket.
4. Armour-piercing bullet with hard steel core, a lead sleeve and soft steel jacket.
5. Tracer and incendiary bullet showing steel core, incendiary material in base, lead sleeve and steel jacket.

Projectiles vary enormously. In revolvers, as a rule, a simple bullet of hardened lead is used, but in all high velocity weapons, such as automatic pistols and rifles, the bullet is composite, consisting of a core of soft lead, or lead hardened by tin, arsenic or antimony, enclosed in a jacket of harder metal, such as copper, cupro-nickel, compounds of zinc and nickel, or, in some cases, steel. The Mark VII rifle bullet, as used by the British Army, consists of a lead core with an aluminium tip, the whole being encased in a cupro-nickel jacket ; most other Powers use a bullet with a soft lead core and cupro-nickel jacket ; the Germans use a lead core with a soft steel jacket, and the French, up till recently, used a solid copper and zinc bullet. Other types may be encountered, such as the armour-piercing bullet, which consists of a hard steel core enclosed in an envelope with a layer of lead between the core and the envelope. Tracer bullets are similar to armour-piercing bullets, but have, in addition, a quantity of barium peroxide and magnesium, or similar substances, enclosed in the base. The heat of the explosion ignites the mixture and the bullet becomes incandescent. Incendiary bullets containing phosphorous may be used and, in certain cases wounds may be found in which portions of these bullets are still hot and smoking in the tissues.

The shape of the bullet varies considerably. In revolver and automatic pistol ammunition the point is usually rounded or ogival, and the bullet is rather short. In all rifle ammunition there has been a tendency, in order to obtain sufficient weight with a limited cross section, to use elongated bullets with a pointed extremity. The body may be cylindrical throughout as in the Mark VII bullet, or streamlined as in the U.S.A. ammunition.

Now let us consider what happens when a weapon is discharged. When the cap is struck the mercury fulminate explodes by detonation and ignites the powder in the cartridge. The powder charge burns from its surface inwards and produces a large volume of gas, amounting to about 300 c.c. per gramme of black powder or 1,000 c.c. per gramme of nitro-powder. As the evolution of gas increases the cartridge case swells outwards, firmly sealing the firing chamber and releasing its hold on the bullet. The pressure starts the base of the bullet moving forwards. This produces a certain degree of mushrooming of the base of the bullet, and this " setting up," as it is called, forces it into the grooves of the rifling and prevents the escape of gas, or at least the escape of much gas, in advance of the bullet. There always is, however, a certain amount of gas which so escapes. The pressure of gas increases until, in the case of the modern rifle, it amounts to about 20 tons, and in the ordinary .45 revolver about 5 tons to the square inch. The bullet passes out from the muzzle, the confined gas behind it gives a backward thrust to the gun, and the sudden expansion of the released gas causes the report. As it emerges it is accompanied by a blast of highly compressed hot gas, particles of unburnt powder, smoke, flame and fragments of wad. At short ranges all of these things are liable to cause some effect on the body, and are extremely important to observe in connection with the diagnosis of firearm injuries, the range and direction, the type of weapon, and so on, as will be described later.

When the bullet leaves the weapon it is acted upon by a series of forces. The most important is the forward movement, and the rate of this movement varies with the pressure of the gas within the barrel. Revolvers in general fire a bullet of low velocity, and in the case of the .45 Webley this rate is about 650 ft. per second. With automatic pistols the velocity is considerably greater, varying from about 1,000 ft. per second to about 1,300 in the case of the Mauser pistol. The muzzle velocity of the service rifle bullet is somewhat less than 3,000 ft. per second.

Rotation, or spin, is imparted to the bullet by the rifling of the barrel. and the rate of spin will vary with the velocity of the bullet and the steepness of the rifling. In the case of the service rifle, since the grooves in the barrel make approximately one complete turn in 10 ins., it is obvious that the rate of spin will be something over 3,000 revolutions per second. This spin keeps the bullet point forward, on the principle of the gyroscope. but, at first, as in all gyrating bodies, for example, the ordinary spinning top, there is a tendency to gyrate around the line of flight ; that is to say, the extremity of the bullet, instead of keeping dead straight, tends to wobble slightly. This instability remains for a few hundred yards, after which the spin keeps the bullet pretty accurately on the line of flight. As the velocity and spin diminish, the bullet again becomes unstable, and at long ranges it may strike side on. The other factors acting upon the bullet and limiting its flight are air resistance, which tends to cause also a certain amount of drift, and gravity, the effects of which are quite well known.

Two other movements of the bullet, tipping and turning, must be considered, and we must be prepared for this to happen at almost any range. It is obvious that any elongated body, with its centre of gravity rather behind the real centre, must be somewhat unstable in flight. Tipping or turning may cause keyhole wounds of entry, or even lacerations, which may have a very deceptive appearance.

Theoretically, the wounding power of a missile might be expressed in terms of its potential energy, *i.e.* $E=\frac{WV^2}{2g}$ where E=the energy in foot pounds, W=weight, V=the velocity, and g=gravity; thus the heavier the bullet and the more rapid its flight the greater the wounding power.

Since the velocity is squared, it is obvious that velocity is the main factor, and in the evolution of the military bullet the striking power has been greatly increased by reducing the weight and increasing the velocity. Since, however, a certain minimal weight is required to inflict a sufficiently severe injury, and since it is undesirable to increase the cross section of the bullet. which would automatically increase the resistance of the air, the elongated pointed type of bullet has been evolved.

It is obvious that the potential energy is not the only factor to be considered in dealing with the wounding power of bullets. If a bag of sand were thrown at a door, the door would possibly be knocked off its hinges. If it were struck with a mallet, a panel might be staved in. If it were struck with a pointed object, a clean hole might be driven through it. In these three cases, exactly the same amount of energy might be used with very different effects, depending, other things being equal, on the area of the striking surface, that is to say, on the cross section of the striking object.

Another factor of importance is the completeness with which the potential energy of the bullet may be converted into work. If a high velocity projectile with a small striking surface passes through the tissues without meeting with any special resistance, it may drive a clean hole without doing particular damage. It is quite possible for a bullet to pass completely through highly important organs without killing, and sometimes without stopping, the person. It may drill a clean hole smaller than itself through bone, and the hole of entry in the skin may be so small that it cannot readily be observed.

This is not always the case, however, for even when little resistance is encountered severe damage may result. When sufficient resistance is encountered to stop the bullet, as, for example, when compact bone is struck, the whole of the energy is converted suddenly into work, and extensive destruction may result, bone being comminuted into powder and soft tissues pulped.

The hydrostatic effect must also be considered. When a rapidly moving object strikes a fluid or semi-fluid medium, the force is distributed in all directions, and this may result in extensive bursting of the particular part, as well as damage to tissues and organs remote from its path. Blood vessels may be bruised and nerves and other structures severely concussed. Other remote results of the commotion may be seen in numbness at the part struck, which may be temporary or permanent, paralysis from concussion of the cord, or more or less severe injuries to the brain, although no entry of the bullet takes place. Blood vessels thus injured may later on be the seat of secondary hæmorrhage or of aneurysmal dilation. The bullet, moreover, imparts its momentum to all particles of tissue which are struck, and such particles are driven forwards with the same velocity as the bullet, and they themselves may act as secondary missiles.

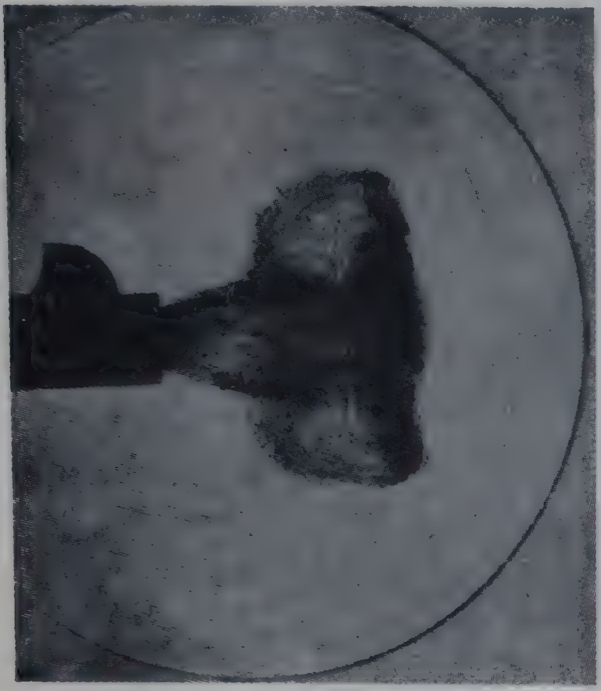


FIG. 28. Photograph of a rifle at the moment of discharge, showing the mass of compressed gas and particles of powder. The circular wave is a sound wave (*Quayle*).

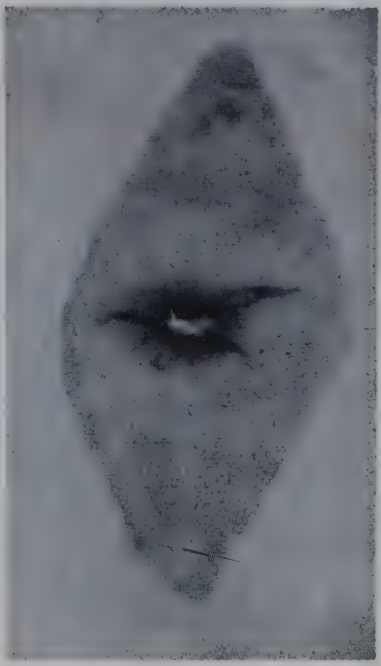


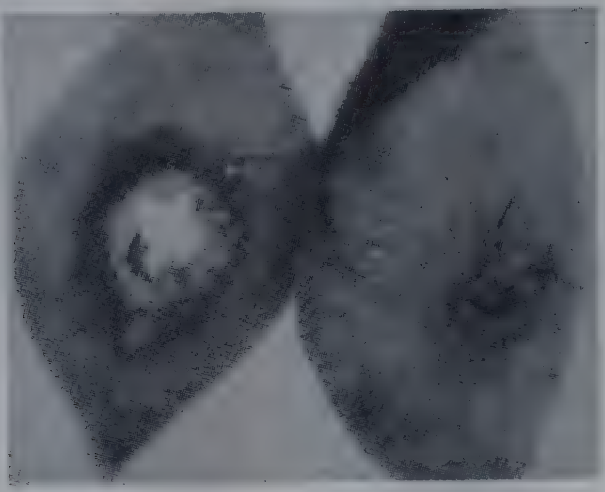
FIG. 29. Entrance wound of a .45 bullet fired in contact with the skin, showing tearing due to the compressed gas and blackening due to powder.

The rate of spin of the bullet is another important factor in dealing with its wounding power. A rifle bullet when it leaves the barrel is spinning at the rate of something over 3,000 revolutions a second, and this terrific centrifugal force is liable to impart its energy to all the tissues through which it passes and produce severe and extensive damage to the tissues, simulating an explosion.

The bullet may pass through the tissues. It may tip before it reaches the tissues, may enter broadside on, or it may turn around in the tissues and be found with the tip facing the entrance wound. This is comparatively common with all bullets. The bullet may "mushroom" or "set up," as it is called, and produce considerable laceration. Lead bullets are easily deformed if they strike a resistant object. Bullets enclosed in a nickel or steel jacket, however, only mushroom as a general rule when the jacket has been damaged or is deficient at the tip, but mushrooming occasionally occurs where no particular obstruction has been met, and when the jacket has not been interfered with before firing. This effect is produced in some cases by interfering with the jacket, either by cutting or by boring a hole in the tip. Since the use of such bullets has been banned by international agreement, it is essential that no opinion should be expressed about the use of dum-dum bullets without the most careful consideration.

The bullet may break into fragments, and it must be remembered that high velocity bullets fired at close ranges may fragment without striking any highly resistant body. This is most important, for there is a tendency to attribute this fragmentation either to explosive bullets or to deliberate damage to the cupro-nickel jacket.

In a series of experiments with the Mark VII service bullet, the .300 bullet, and the .303 (U.S.A.) service bullet, I have observed complete disintegration of the bullet when firing into soft clay at ranges from 10 to 300 yards. This I believe to be due to the velocity and spin, for in comparative experiments over the same distance into the same medium, with the same weapon and ammunition, but with charges of powder reduced, no fragmentation of the bullet was observed. In low velocity weapons fragmentation is rare.



Entrance *Exit*

Fig. 30.—Wounds from a .303 rifle.

The diagnosis of firearm wounds is made from the appearance of the entrance and exit wounds, the track of the bullet, and the presence of foreign matter in or around the entrance wound, in the tissues or in the clothing.

Entrance Wounds. In the case of bullet wounds the entrance is comparatively small; it may appear to be smaller than the missile owing to the elasticity of the skin, with edges more or less inverted and bruised or lacerated. The edges of the wound commonly show a narrow ring of discoloration due to the removal of a layer of epithelium by the passage of the bullet. The surrounding skin may be scorched or not, and there may be a zone of blackening or peppering with grains of powder, according to the distance from which the weapon was fired.

We must distinguish between near wounds and far wounds. Usually when a weapon is discharged in contact with, or within an inch or so, of the body, the gases which pass out with the bullet enter the tissues and thereafter expand, causing tearing of the skin or clothes, very often in the form of a cross or a split. Most of the powder is found inside the tissues, but there may be traces of blackening, burning and tattooing around the entrance hole. Hairs in the vicinity may be clubbed or burnt. If the weapon is discharged at a short distance from the skin, the effect of the gases is lost and the entrance wound looks like a hole which might be caused by pressing a lead pencil into the tissues ; it is rounded, with inverted edges, and surrounded by a zone of singeing, blackening from the smoke, and tattooing from the impaction of small particles of powder in the skin. If these are found in a compact zone around an orifice of entry it indicates that the shot has been fired within a few inches. As the range increases, dispersal occurs, the marks of burning are soon lost, and the tattooing from the powder becomes more discrete until no trace of powder marks can be found. In revolver and automatic pistol wounds nothing is likely to be found beyond about 2 feet.

Care is required in examining for powder marks, especially in the case of automatic pistols, for smokeless powder is not black and may appear as small particles of gelatine or minute threads or flakes on the surface. Beyond 2 or 3 feet nothing will be seen to indicate the range, and in deciding whether it is an entrance wound or not, we have to be guided by the injury itself. All entrance wounds, if examined, will be found to have a zone of denuded epithelium immediately surrounding the orifice. This is caused by the spin of the bullet and the invagination of the skin by the bullet, and tends to dry and become discoloured shortly after death. It should not be confused with the marks due to powder for it gives no indication of range. The direction can be ascertained also from observing the driving of fragments of clothing into the wound and the driving of one tissue into another. When the body is being dissected careful attention should be directed to the disposition of diplaced tissues. An X-ray examination before dissection is often of great value in this regard.

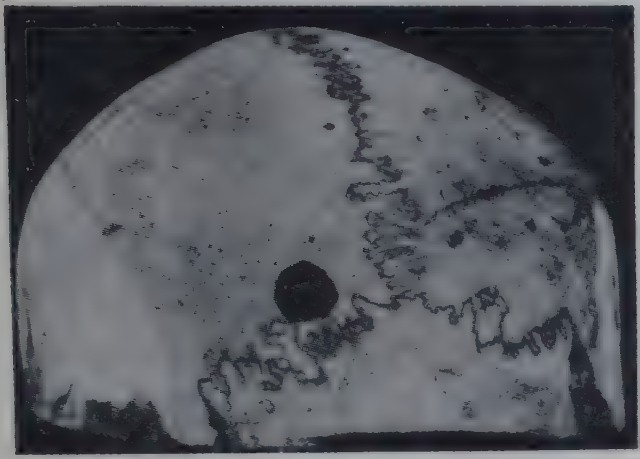


Fig. 31.—Skull cap showing the entrance hole of a .45 inch revolver bullet. Note the clean-cut margins of the wound

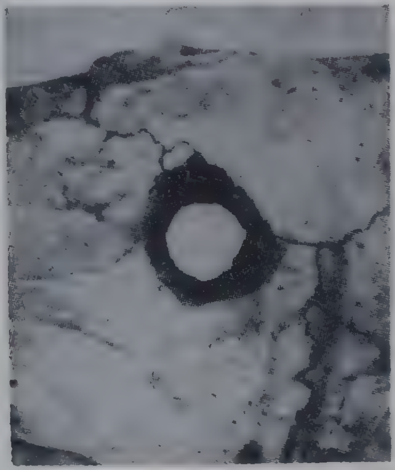


Fig. 32.—The inner side of the same bone to show the bevelling of the edges which occurs at the point of exit of the bullet.

If the projectile traverses a bone the direction of fire may be ascertained from the difference in the margin of the wound of entrance and exit. Bone always tends to bevel at the point of exit (Figs. 31 and 32). and therefore the entrance is usually clean cut whereas the exit is bevelled in a cone-like manner.

The shape of the entrance is usually circular, if the bullet strikes at right angles to the surface, but tends to become increasingly oval if fired at an angle until the bullet glances across the tissues, producing an injury similar to a cut or lacerated wound.

The entrance wound in the case of a shot-gun may show as a single lacerated hole about the diameter of the gun-barrel, and surrounded by a zone of blackening or burning if discharged within a short distance (see p. 440, " Distance from which fired ").

Exit Wounds. These are always free from signs of burning, blackening or tattooing from powder. They are usually torn from within outwards and are almost always bigger than the missile. If the bullet passes through a bone or other solid object, it shows a fairly clean-cut hole at the orifice of entry and an excavated cone-shaped hole at the exit. In skull bones, for example, the entrance wound in the outer table will show a hole approximately the size of the bullet, and the inner table a cone-shaped hole due to the flaking off of a piece of the inner table. This is due to the forward drive of the bullet and may be found in skull wounds even when the bullet does not perforate the bone. This must be carefully remembered, for a ricochet or a glancing blow from a bullet may be overlooked, and only in later years is it found that fragments of the inner table have been driven into the brain and have caused trouble. I have notes of fifteen such cases which were only discovered years after the 1914–18 war.

Diagnosis. If a wound or wounds have been produced by a missile from a firearm, there must be from each such missile either an odd or an even number of wounds. If an odd number has been produced, it follows that the missile must be still in the wound, and a careful search will reveal its presence.

There are rather important exceptions to this rule, *viz.* (*a*) when two are ordinary gunshot wounds and the last one a mere groove or graze, (*b*) a single bullet may split and thus produce one wound of entrance and two or more wounds of exit, and (*c*) in shot-gun wounds there may be only one wound of entrance and any number of exit, but these exceptions are so obvious as to require no discussion, for they should not in practice lead to difficulties in diagnosis.

If there are an even number of wounds, then some of them must bear the characters of wounds of entrance, and some those of wounds of exit, characters which are practically conclusive of the nature of the wounds.

If the missile is found not in the body, but in the room, this is a piece of circumstantial evidence to be weighed with the character of the wounds. It is, however, not conclusive proof, for this missile may not have been the cause of the wounds, and may merely prove the discharge of a firearm.

If fragments of powder, portions of the wad, etc., are found in the wound they are conclusive evidence of the nature of the causative agent. Further discussion of them will be found below, under the heading " At what Distance was the Firearm Discharged ? "

If only a superficial bruise or abrasion is found, it is impossible to say positively that a firearm caused it ; but even with superficial glancing wounds, the grooved appearance in the skin and the nature of the holes in the clothing and the spectrographic examination for metallic and other residues may enable the examiner to give an opinion on the matter.

Having decided that the wound is due to a firearm, the direction may be deduced from the position of entrance, exit and track, bearing in mind the possibility of deflection of the bullet and the different relationship of the parts of the body in movement. The range is estimated from the observation of marks of smoke, flame, or tattooing in wounds which are relatively close. When the range is greater, it can be estimated only approximately and with difficulty from the destructive effects and penetration.

As a general rule with revolvers and automatic pistols, there is no considerable destruction of the parts. The case is entirely different however, with regard to rifle wounds.

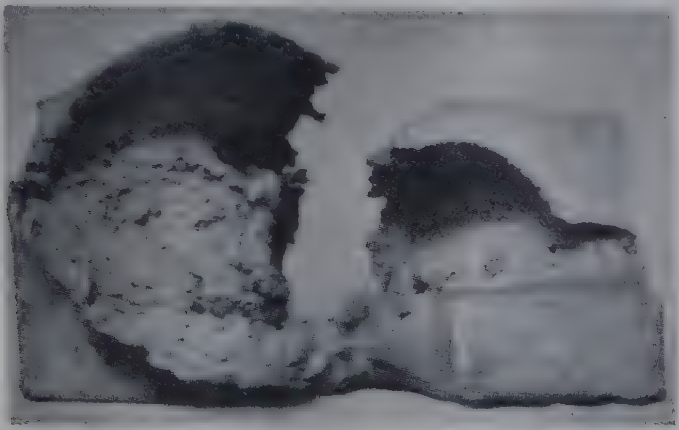


Fig. 33.—Cavity produced by firing a .303 bullet into clay.

The modern rifle fires a bullet with a velocity of about 3000 feet per second, rotating at a rate of something over 3000 revolutions per second. The bullet is kept point forward by the gyroscopic effect of the spin, but like a top tends to wobble somewhat at the beginning before it settles down. This continues for several hundred yards, and in dealing with wounds from rifles we must be careful to distinguish between those inflicted at relatively short ranges up to a few hundred yards, the middle ranges from 600 to 1,200 yards, and those beyond that.

In the first group we are liable to get explosive effects ; in the second group we are liable to get clean punctured through-and-through wounds ; and in the third group we are again liable to get irregular lacerated wounds, owing to the loss of velocity.

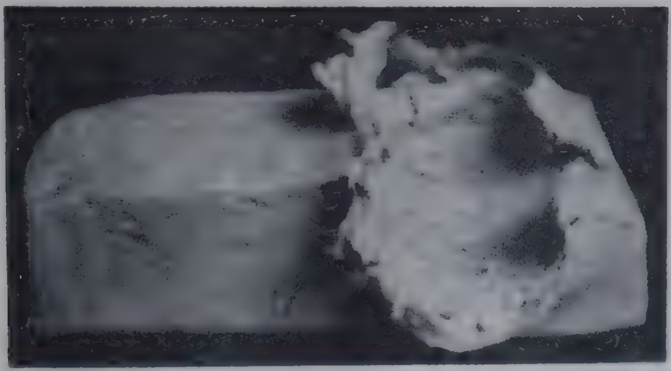


Fig. 34.—Cavity produced by firing a .303 bullet into clay. The bullet never entered the block but struck the edge only. The same disruptive effect was produced.

To illustrate the first group, if an ordinary ·303 bullet is fired into modelling clay free from all hard particles, it produces a fairly sharp hole of entry about half an inch to an inch in diameter, passes in in a cone-like manner for a few inches, then suddenly smashes the material in all directions, forming a cavity about a foot in diameter. The bullet itself commonly breaks up, sometimes into two or three pieces, sometimes into innumerable fragments. A portion of it may fragment and the rest pass forward, but practically never in a straight line. This disruptive effect occurs at any distance within a few hundred yards. The reason for such cavitation has been the subject of much discussion, and many observers have assumed that it is due to a pad of compressed air being forced in front of the bullet into the tissues. That this is not the case we have proved by many experiments—for example, by firing through a rubber sheet before the bullet enters the clay, by firing through two blocks of clay with an interval between (Fig. 33), and by firing a bullet to strike on the side of a block of clay so that no balling-up in front of the bullet is possible (Fig. 34). In all these experiments the same cavitation occurs.

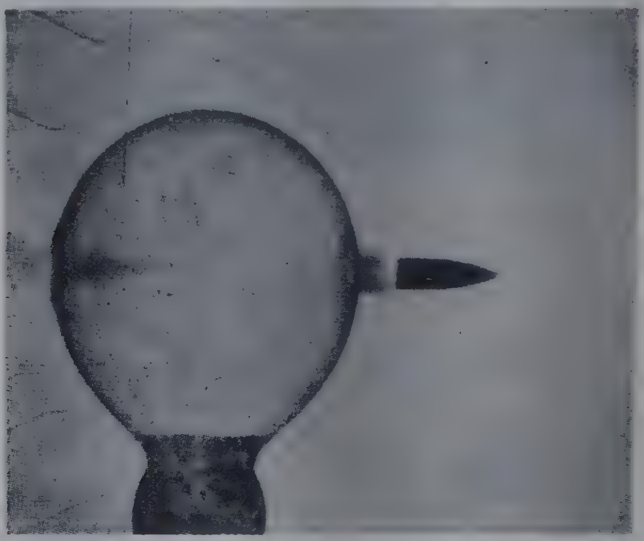


Fig. 35.—Rifle bullet fired through a soap bubble (*Quayle*).

The observation of bullets in flight photographically shows no compression pad of air in front, and when bullets are fired through a soap bubble (Fig. 35) no disturbance is produced which would occur if such a pressure pad were carried in front of the bullet. Experiments carried out with perforated lead bullets with a broad canal bored from tip to base show the same formation of a cavity when fired into clay as a whole bullet.

It has been suggested that the explosive effect is due to the bullet creating a vacuum behind it, with a consequent inrush of air to fill the vacuum. An examination of the bullets in flight shows that there is a definite but not extensive commotion in the atmosphere behind the bullet, and there is no doubt that a negative pressure is produced when the cavity is formed, leading to an inrush of air, but if plasticine is placed on the front of the block it is not drawn to any appreciable extent into the cavity, but is distributed mainly at the orifice. Photographs of the perforation of a soap bubble by a projectile show no deformation of the bubble such as would occur if a vacuum were produced and, finally, the experiment in which the edge of a block of clay has been struck, where no possible vacuum could occur, proves that this cavitation is not due to any such cause.

Experiments carried out in exactly the same conditions, in which the charge has been reduced to half or a quarter, thus cutting down both velocity and spin to the same amount, show that with the lower velocity and consequently diminished spin, less deformation of the medium takes place and the bullet is not disintegrated.

It is obvious that when a pointed object, travelling at the rate of about 2,000 miles an hour and spinning at something under a quarter of a million revolutions a minute and, at the same time, gyrating around its own axis, strikes moist tissue or any semi-diffluent medium, each one of the above-mentioned factors must set the tissues in motion, and as the bullet passes forward successive layers are set in motion producing a summation which causes complete cavitation.

Why fragmentation of the bullet should take place is hard to understand. There is a highly resistant jacket of cupro-nickel which one would not expect to rupture unless it struck a hard object, but this does not appear to be necessary, and we are drawn to the conclusion that the projectile disintegrates from the effect of its own centrifugal force.

It might be considered that this explosive effect is a peculiar function of the clay, but the following cases show that similar effects are produced in the human body.

In one of my cases an escaping prisoner was shot from a distance of about 60 yards. The bullet entered the back, making an entrance hole that could be found only with difficulty, passed through the chest, making a ragged exit wound 4 ins. in diameter in the front of the chest. On dissection the heart was found to be completely destroyed and smashed into minute unrecognisable fragments, and the bullet was also in pieces, although no resistant structure had been struck.

In another case a man was struck on the head, from a range of about 20 yards, by a service bullet. The top of the head was blown off and the whole of the brain destroyed.

Another instructive case in which a soldier fired at a motor-car in the black-out during an air-raid alarm shows the disintegrating power of high velocity bullets. Only one shot was fired. The bullet passed through the celluloid window at the back of the car, entered the chin of the passenger on the right side, making a clean circular depression, and passed out at the left side, where it caused considerable laceration of the tissues.

The windscreen in front of the passenger was perforated in three places with holes similar in size to a ·303 bullet. In addition there were numerous partial fractures of the glass, and a distinct indentation in the metal rim of the screen. The aluminium tip of the bullet, with casing complete, was found on the back seat. Comparison of the tip with the oval indentation on the windscreen showed that the tip had ricocheted from the windscreen to the back of the car. The various marks on the windscreen were examined chemically and showed traces of lead and nickel. Numerous fragments of lead and nickel and minute fragments of skin were found on the floor in front of the driver's seat and round about the base of the windscreen.

X-ray examination of the lower jaw showed that the bone was smashed into fragments, amongst which there was found a particle of lead. The victim died a few days later from septic broncho-pneumonia, and the assailant was charged with murder.

The number of shots fired was of prime importance. If more than one was fired then the case was obviously much more serious for the accused, and the number of marks certainly suggested that three shots had been fired. One shot only was heard, one cartridge case only was found, and a reconstruction at the scene of the crime proved that more than one shot had certainly not struck the car. The appearance of the entrance hole showed that the bullet was complete when it struck the chin of the victim; a fragment of lead amongst the shattered bone showed that it had disintegrated after touching the chin, and the whole of the fragments were then projected with sufficient velocity to produce three exit holes in the windscreen and trafficator and numerous partial fractures of the triplex glass. The whole of these bizarre effects were produced by one bullet, giving an excellent example of the way in which an ordinary bullet may disintegrate in the tissues as if it had itself exploded as well as causing an explosive effect in the tissues.

A further example of this explosive effect is shown in the case of a young deserter who was shot from a distance of about 15 yards by a service rifle. The bullet passed through both legs from left to right, and the victim died in about an hour from hæmorrhage (Fig. 36).

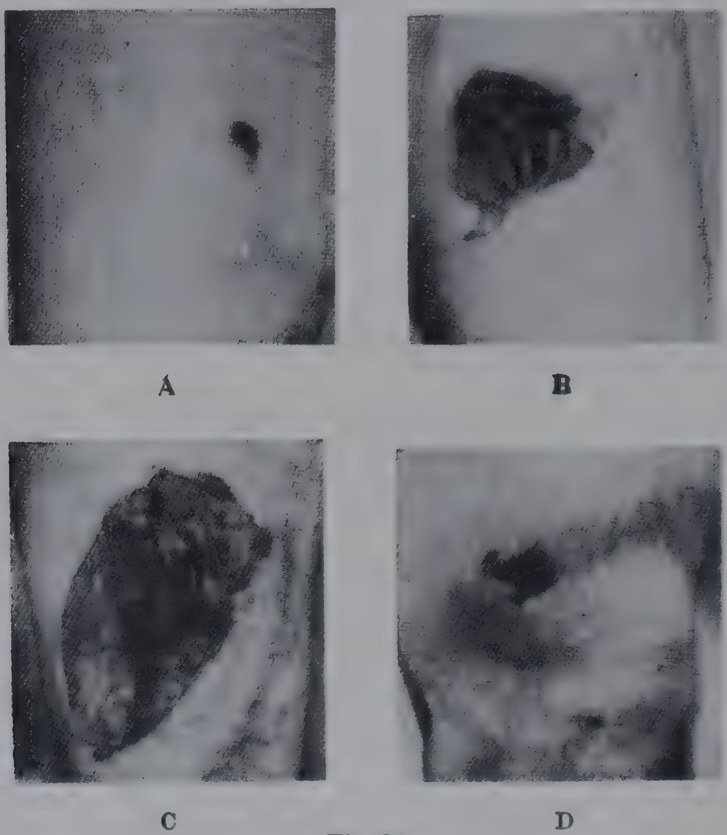


Fig. 36.

A, entrance in left leg B, exit in left leg
C, entrance right leg D, exit right leg

The hole of entry in the outer side of the left thigh was an ordinary clean-cut hole about $\frac{1}{4}$ in. in diameter (A). It traversed the fleshy part of the thigh passing below the femur, and made its exit on the inner side. The tissues were severely lacerated and the hole of exit was $2\frac{1}{2} \times 2\frac{1}{2}$ ins. (B). The bullet then entered the inner side of the right thigh causing a lacerated injury 6×3 ins. in size (C), struck the lower end of the femur, smashed it into fragments, destroyed the femoral artery and nerve, and made its exit on the outer side, making a wound about 1 in. in diameter (D).

Innumerable fragments of the bullet were found in the tissues, showing that the bullet had broken up in the muscles before it smashed the bone. The remains of the projectile made its exit on the outer side of the right leg.

These injuries are strictly comparable with the experimental effects in soft clay and are due no doubt to the centrifugal force of the spinning projectile, causing explosive effects in the soft tissues and disintegration of the bullet.

In a large number of cases clean perforating wounds are caused and there may be extremely small entrance and exit wounds and comparatively little destruction in the track. These are most commonly found at ranges beyond 500 yards. There may be through-and-through wounds of the head from which recovery may be complete. Whittaker[1] quotes a number of such cases, including a through-and-through wound from the left parietal to the left frontal region ; a through-and-through wound of the right frontal region ; and a double frontal injury in which almost all the external parts of both frontal bones were smashed, the superior longitudinal sinus torn across and the wound infected. All of these cases made a complete recovery. Another through-and-through wound in the occipital region caused temporary blindness, and the patient eventually recovered.

There are other cases on record of perforation through various organs which might have been expected to cause certain death but in which complete recovery took place.

Fig. 37.—Bullet embedded in heart.

Gilchrist[2] quotes the case of a man who received a wound with impaction of the bullet in the heart ; he returned to civil life, and has to date been free from any obvious infirmity. I have notes of a similar case of a man who was wounded with a rifle bullet in 1917 and who has since carried on his normal work ; and another case of an individual who is at present apparently in perfect health with a rifle bullet embedded in his brain.

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[1] *British Journal of Surgery* (1916), 3, 718.

[2] *British Medical Journal*, 20th April, 1929.

On the other hand, injuries may be caused by projectiles which do not lead to any immediate disability but in which disability occurs after a period of years; for example, Mutel[1] gives a series of cases of men wounded in the head during the 1914-1918 war in which the first complaint was made seven, thirteen, sixteen, and seventeen years after the injury, and in which fragments of foreign bodies embedded in the brain were observed by X-rays. Foreign bodies in the brain may be particles from a projectile which passed through the skull without the injury having been observed, or slap wounds, in which the projectile has struck at a tangent, and, without entering, has driven portions of the inner table into the brain. Cases such as these may show few symptoms, for the tolerance of the brain to foreign substances is very remarkable indeed, but there is always a chance of neurological effects supervening after long periods, and it is essential that this possibility should be bo ne in mind.

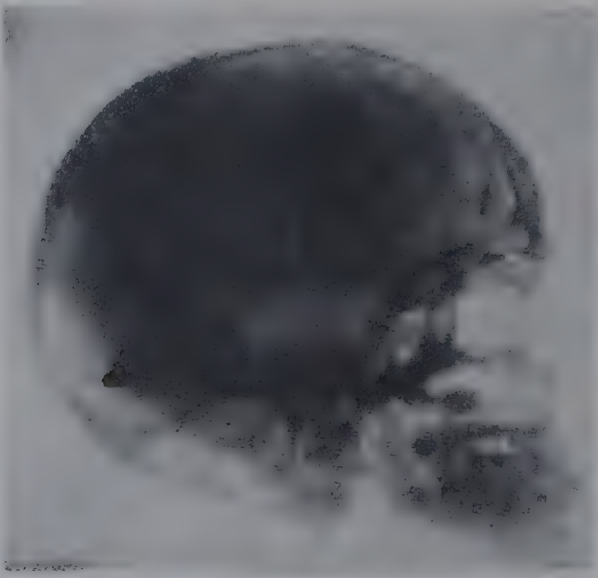

Fig. 38.—Bullet imbedded in brain.

In other cases a bullet may pass through the body and inflict a glancing wound on the aorta. Healing may be complete and no particular symptoms observed for many years afterwards, when an aneurysm may be found to have developed in the area of damage.

Many other secondary effects may be produced, as has been mentioned before, from the sudden pressure and commotion of the bullet, and if these possibilities are kept in mind it will prevent injustice being done to the individual in many cases.

TIME OF INFLICTION OF THE INJURY

A witness may be asked: When was the gunshot wound inflicted? Like other wounds, a gunshot wound undergoes no marked change for an hour or so after its infliction. Our judgment in reference to this question may be assisted by observing the parts which are involved and the blood that has escaped, although we cannot always infer from the quantity of blood found near to a body that the bleeding was an immediate consequence of the wound, or that the whole of the blood was effused at once. We cannot, then, always affirm that the deceased could not have moved or exerted himself in some degree after receiving it. The exertion thus made subsequently to his being wounded may have actually caused the fatal bleeding.

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[1] *Annal. Med. Leg.* (1935), 15, 1435.

If the wound be of something over ten or twelve hours in age, its age must be judged on general surgical principles by the amount of hæmorrhage, swelling, vital reaction, suppuration, etc.

HOW LONG DID THE VICTIM SURVIVE ?

This question can only be answered by (*a*) the nature of the wound, (*b*) the organ wounded, (*c*) the state of the wound as regards suppuration, gangrene, healing, etc., and (*d*) the amount of blood lost.

WAS THE VICTIM ALIVE WHEN SHOT ?

A medical witness may be asked whether the wound was inflicted *before or after death*. It is by no means easy to answer this question, unless the bullet has injured some vessel, when the effusion of blood and the formation of coagula will indicate that the person was living when it was received. If a gunshot wound has been produced in a dead body, no blood will be effused, unless the bullet strikes a large blood vessel.

The question is, however, very little relevant, for if in ordinary wounds, when a murderer may be frenzied, or a suicide half-hearted, it seems futile to ask who but a murderer would injure a dead body, *a fortiori* there is still less reason to ask the question who would shoot a dead man.

If a gunshot wound be found on a dead body together with other wounds it might be of importance to know which wound caused death. This, like many other points, can only be judged by general principles, such as the nature of the wounds, the parts injured, the amount of hæmorrhage, etc. (*vide* "Causes of Death in Wounds," p. 264, also case on p. 453, blow on forehead and shot).

IS THE WOUND DANGEROUS TO LIFE ?

Again, a very definite and decided difference is found between wounds from high velocity weapons and those from ones of low velocity.

In the 1914-18 war there were thousands of cases in which bullet wounds of soft tissues, and even of the bones, were followed by practically no symptoms whatever, and the soldiers were frequently able to return to duty in a very short time after bullets had traversed regions usually considered dangerous.

A soldier was standing on a rock, when suddenly his foot slipped, and he fell some few feet on to his shoulder. He was treated for "Contused Shoulder." He could not return to duty for some weeks on account of considerable paralysis, the apparent result of the contusion. On careful examination it was subsequently found that a bullet had passed in at the mouth through the palate, thence through the base of the skull and through the brain at its base, and out by the occipital bone.

There were numerous instances of perforations of the lung, liver, kidney, bowels, stomach, intestines, etc., wounds usually considered very dangerous, if not even necessarily fatal, but in which rapid recovery ensued provided that no treatment was adopted, and the victim took no food nor drink.

On the other hand, very extensive damage may be done internally without there being much external evidence of it.

All gunshot wounds are dangerous to life, first from shock, secondly, from laceration of a large blood vessel or important viscus, such as heart, brain, liver, etc.; and thirdly from the effects of sloughing, hæmorrhage, extravasation of the contents of a hollow viscus, septicæmia, etc.

So long as the missile remains in the body there must be a certain amount of danger, although there are numbers of cases on record in which the patient has led a normal useful life in spite of the fact that he had a bullet embedded in his tissues. Danger must be taken to be in some degree proportionate to the inaccessibility of the missile coupled with its proximity to an important organ which could be damaged either by inflammation or by the shifting of the missile, or could have been slightly damaged at the time, with increased opportunity therefore for further mischief. An inquest was held at Fulham on the body of a man who died as the result of a sudden attack of "epilepsy" and who three years previously had been shot in the head. At the *post-mortem* examination it was found that death was due to septic meningitis set up by the bullet.

In another case a patient with a bullet wound of the abdomen suddenly died after seven days' illness. At the necropsy a retro-peritoneal lesion of the abdominal aorta was found, with enormous hæmorrhage.

As a general rule a wound from a firearm which is not immediately fatal is more dangerous than one from a knife or bayonet or similar weapon.

Instances of gunshot wounds proving fatal after a year and a day are not infrequent, and they demonstrate the inconsistency of limiting the legal responsibility of an assailant according to the period at which death takes place.

AT WHAT DISTANCE WAS THE FIREARM DISCHARGED?

In a large number of cases this has been made a very material question, and it is by no means an easy one to answer definitely.

Much relevant information has already been given on which a diagnosis can be made.

In general we depend on the observations of the effect of compressed gases, the burning, blackening and tattooing and their extent in any particular case. At ranges greater than a few feet these features are no longer present and we are guided only by the effects of the projectile on the tissues and clothes as has already been described.

In the case of **shot-guns** the distance from which the weapon was fired may be deduced from the amount of scattering of the charge. At about a yard the whole of the charge enters in a mass, producing a round hole about the size of the bore of the weapon, with ragged edges and surrounded by a zone of blackening and burning.

As a rule, there is little trace of burning beyond a yard, but traces of powder marks may be found up to four yards or more. The shot begins to disperse in an ordinary cylindrical barrel at about three yards, at which distance the bulk of the shot enters in one mass and leaves a hole with a few isolated shot around it. The dispersion gradually increases, and at about five yards an open pattern about ten inches in diameter is found. At ten yards the diameter of spread is about twenty inches, at twenty yards about thirty inches, and so on. With fully choked barrels the dispersion is about half the above. With pistols loaded with shot the dispersion is very much greater.

These figures are given as a working basis, but it must be remembered that the dispersion varies to a certain extent with different weapons, and to a great extent with the nature and quality of the powder and the manner of filling or loading.

Both the clothing and skin of a person who has received a gun or pistol shot wound should be closely examined. The result may be that the statement given of the mode in which a wound was received will be entirely disproved.

A tithe-collector was tried for the murder of a man by shooting him. It appeared that the prisoner was attacked by the deceased and two of his sons, and that he drew a pistol to intimidate them. He was dragged off his horse by the assailants and during the scuffle, it was alleged, the pistol was discharged accidentally and inflicted a wound on the deceased, from which he died shortly afterwards. The sons of the deceased swore that the prisoner took a deliberate aim and fired the pistol at their father when at some distance, and a priest deposed that such was the dying declaration of the deceased. Doubts being entertained as to the truth of this story, the body of the deceased, which had been carelessly inspected in the first instance, was disinterred. It was again examined by a surgeon, who was enabled to swear positively that the pistol must have been fired close to the body of the deceased, and not at a distance, since there were the marks of powder and burning on the wrist. Hence it followed that the pistol had not been discharged at a distance, but during a scuffle, either by accident or in self-defence. The prisoner was acquitted, and the parties who had appeared as witnesses against him were convicted of perjury.

Burning of the Wound. The amount or degree to which the clothes and body of a person may be burnt by the near discharge of firearms has given rise to a medico-legal inquiry. The facts in any given case can be determined only by experiments with the actual weapon used, and loaded as nearly as possible in the same manner as it was when used for the purposes which are being investigated. It is impossible to state rules as to the precise distance from which it is possible to produce marks of burning, for this depends on the quantity and nature of the powder, the method of charging, and the nature of the weapon. It is unusual, however, to get marks of burning beyond a yard or a yard and a half with a shot-gun, or at more than half a yard with a revolver. There are but slight signs of burning with automatic pistols, even at a few inches, for the charge of powder is very light, and it is completely exploded. The bruised and dark appearance which a gun-shot wound sometimes presents, even when the weapon is discharged at a distance from the body, has led to the supposition that this effect was due to a burn, and that the bullet burnt the parts which it touched, but this idea is not correct. The projectile never becomes sufficiently heated to acquire the power of burning.

Wounds and Marks from Wad, Powder, etc. A gun loaded with a wad, or even with gunpowder only, may cause death. In these cases an impulsive force is given by the explosion, and the substance becomes a dangerous projectile. The lighter the projectile, the shorter the distance to which it is carried; but when discharged near to the body, it may produce a fatal penetrating wound. A portion of the dress may be carried into the wound, and lead to death, either from mechanically wounding a vessel or organ or from sepsis. Fatal accidents frequently occur from persons discharging guns or pistols at others in sport—an act which they think they may perform without danger, because the weapons are not loaded with ball or shot.

In *R.* v. *Race* the prisoner killed the deceased by discharging at him, within a few feet, a gun loaded with powder and paper wadding. The deceased fell and died in a few minutes. It was found that the chest was penetrated, and that the wadding had wounded the left auricle of the heart. A girl was killed by a boy, who discharged at her a gun loaded with paper pellets. Some of these penetrated the body and lodged in the lungs and liver. Dupuytren mentions an instance where, during a quarrel between two men, one discharged at the other a gun loaded with powder and wadding only at a distance of about eighteen inches. The man instantly fell dead. On inspection his clothes were found torn, the intestines were lacerated, blood was effused, and the wadding was lodged in the abdomen.

A man, sitting in the gallery of a theatre at Brighton, had a half of one hand completely blown away by a piece of greased newspaper, tightly rammed, discharged from a small cannon on the stage of the theatre.

It has been observed that persons in attempting to commit suicide have occasionally forgotten to load the weapon with a projectile. Nevertheless, the discharge into the mouth has sufficed, from the effect of the wad and of gas pressure, to produce considerable destruction of parts, and to cause serious loss of blood. It is not easy to say at what distance a weapon with a blank charge would cease to produce mischief, since this must depend on the impulsive force given by the charge of powder, and on the type of weapon.

A case occurred in the United States involving the question as to the distance at which a pistol *not* loaded with ball would suffice to produce a serious wound.

A boy in play discharged a pistol at a companion, producing on the fleshy part of the left hip a wound one inch in diameter and four inches in depth. The skin was destroyed, and the muscles were a blackened lacerated mass. There was no ball in the pistol; but it is not certain whether there was wadding. Death took place from tetanus on the seventh day, and on examination no wadding was found in the wound. There were, however, grains of gunpowder, with which the wound was blackened throughout its whole extent. At the inquest the witnesses differed respecting the distance at which the pistol was held when the wound was inflicted. Some said one foot, others two or three yards. The deceased had stated his belief that the pistol had almost touched him, and, judging by the state of the wounded parts, this was probably the truth.

Swift contended that the wound had been produced by gunpowder only, without wadding. He performed some experiments with the pistol used by the prisoner, but loaded with gunpowder and *wadding*, in order to determine the effect of the discharges at different distances. At twelve inches distance from a body he found that the clothes were lacerated and the skin abraded, but the wadding did not penetrate; at six inches the clothes were lacerated, and the wadding penetrated to the depth of half an inch ; at two inches the wound produced, which was two inches deep, was ragged and blackened ; at one and a half inches from the chest the wadding passed into the cavity between the ribs, and in a second experiment it carried away a portion of a rib. This subject was investigated by Mackintosh, and he found, in reference to the wounds produced by wadding, that the amount of injury done is in proportion to the amount of powder in the gun, the hardness and compactness of the wadding or substance used in place of shot or bullet, and the distance of the object from the point of firing. A case occurred in his practice which was the subject of a trial for unlawful wounding :—

R. v. *Isgute.* The prisoner fired at a boy with a gun loaded with brown paper, pressed together. He was then at a distance of two or three yards from the boy. There was a wound in the chest about the size of a shilling. The margin of the wound was jagged, had a bluish black or mottled appearance, and the edges of one of the ribs were laid bare. The paper pellet took a course downwards, as a result of a deflection of the projectile by the rib. A quantity of brown paper was removed from the wound, and the boy ultimately recovered.

The question which Mackintosh proposed to consider was whether paper wadding could really produce such a wound as was here found when the gun was fired from a distance of *two or three yards.* Without going into details, it may be stated that when the gun was charged with a small quantity of powder and brown-paper wadding there was indentation, but no penetration at a distance of two yards. With one-third more powder and a brown-paper pellet closely compressed, there was penetration through the boy's jacket to an inch and a half beyond. These facts confirmed the boy's account of the distance from which the gun was fired at him by the prisoner. Swift had inferred from his experiments that a penetrating wound from wadding was not produced unless the piece were discharged within a distance of six inches ; but Mackintosh's results clearly show that this must depend on the quantity of powder used, and the loose or compact nature of the substance employed as a projectile.

Powder Marks. A portion of the powder always escapes combustion at the time of discharge, and each grain then acts like a pellet of small-shot, contuses the skin, producing ecchymosis, and often lacerating it, if the weapon is fired at a close range. The clothing is burnt, and the skin scorched from the flame formed by the combustion of the powder ; many particles of gunpowder may be actually driven into the true skin.

Powder marks are more profuse and more easily seen when black powder is used. Smokeless powders are more completely burnt, and leave, as a rule, less deposit. The grains being colourless are less easily detected, and may entirely escape observation unless a hand lens is used. In general we may consider that marks of burning, of blackening, or of tattooing from powder grains indicate that the weapon was fired from a near distance.

HOW WAS IT INFLICTED ?

This question is as a rule somewhat easier to answer in the case of gunshot wounds than in ordinary wounds ; it means, of course, Did the deceased receive the wound while standing or lying down, while running away or approaching ; in what direction was the weapon pointed when fired ; was it fired from the shoulder ? The points we have for the solution of the problem are :

The evidence of eye-witnesses.

The wound of entrance contrasted with that of exit.

The direction of the track which joins the wound of entrance either with the missile or the wound of exit.

Evidence derivable from a multiplicity of wounds.

The Evidence of Eye-witnesses. This is, of course, extremely variable in quality both as regards absolute reliability and clearness, even where there is no object in concealing the truth, but inasmuch as the report of a firearm can always be heard, even in the midst of the loudest quarrel, it is more probable that the attention of those near would be immediately attracted than in the case of the use of a knife or other silent weapon. Not only would the attention be thus drawn to the firing of the weapon, but the details of the occurrence would also be more likely to be thereby fixed on the memory, whether, for instance, the shooter was standing, lying or kneeling ; whether the victim was in a similar or different position ; in fact, if there are witnesses of the occurrence their evidence is generally very direct. In the following case, for instance, no difficulty arose on this score :—

Pong Lun was charged with having murdered Go Hing. A quarrel arose, and the prisoner left the room, returned, and directly afterwards he fired two shots at the deceased and two more outside the room. The revolver, a five-chambered one, was picked up, and four spent and one live cartridges were found in it. Witnesses deposed to all the movements of the prisoner and to the manner of the shooting. The bullet that caused death had passed through the abdomen, injuring the intestine, kidney, and pancreas. These injuries had caused peritonitis and also severe loss of blood. The prisoner was found guilty, sentenced to death, and hanged. His counsel pleaded for a verdict of manslaughter, but the judge overruled this on the grounds : (1) That the prisoner had deliberately gone out of the room to fetch the lethal weapon. (2) That he was not so drunk as to prevent him from understanding the nature of his act.

Wound of Entrance contrasted with the Wound of Exit. For the actual differences *vide ante*, p. 430 *et seq*. It is, of course, obvious that the position of the wound of entrance marks the part of the body which was at the moment of discharge nearest to the muzzle of the weapon, or rather in a straight line with the muzzle ; it therefore indicates with mathematical precision whether the victim was facing the muzzle or with his back or side to it, except in the case of a ricochet shot of which there may or may not be evidence.

Direction of the Internal Wound. Speaking in broad, general terms, the missile fired from a firearm has a tendency to continue in a straight line from the point of entrance to the point of lodgment, or to the wound of exit, so that, if the internal wound be straight, this straight line proves accurately the direction in which the barrel of the weapon was pointed when fired. But it must be particularly noted that very frequently this wound is not straight, but curved, the missile being deflected from its original course by slight obstacles, such as bones, etc.

From the above rule it follows that if a person be shot in a standing position, and a wound be found nearly transverse through the chest, the firearm was certainly fired from about the level of the shoulder, a position which may have important bearings as to intent, accident, or homicide. Again, if we can at any time discover two fixed points where a ball has touched a *building* without being deflected, it will be easy to determine the *direction* from which the weapon was discharged.

In a case at Ayr several shots had been maliciously fired into a church. Som of the bullets traversed a window, making holes in the glass, and struck against a wall on the other side of the church—a fact plainly indicated by the marks which they left. A straight line carried from these two points reached a window on the opposite side of the street, from which it was afterwards ascertained the bullets had been fired. In another case a similar piece of evidence clearly showed that a gun loaded with a bullet had been maliciously discharged with a design to kill one of two persons. The prosecutrix and her mother were sitting by candlelight one evening near a window in their house, so that their shadows were projected on the blind ; a bullet passed through the window and struck the wall of the house inside. A line drawn between these points was about half an inch over the head of the prosecutrix, and about one inch below the level of her mother's head. Neither was hurt. The prisoner was connected with the act by his having been seen near the spot, and by a variety of circumstances. It was alleged in defence that the prisoner had gone out with his gun in the evening to shoot birds with bullets, and that the piece had been discharged by some accident. The judge directed the jury to consider with what intent a shot could have been fired so as to come within half an inch of the head of a person. The prisoner was convicted.

In judging of the *direction* taken by wounds which traverse the chest from front to back, it is necessary to remember the great difference that exists in the level of the same rib anteriorly and posteriorly. This must be especially attended to when one is called upon to state the direction of a traversing wound from the description of it given by another. A reference to an articulated skeleton must always be made, and also to frozen sections.

A person died from a single pellet of small-shot traversing the chest from before backwards. The pellet entered between the first and second rib anteriorly, and traversing the lung, caused death by lacerating the sixth intercostal artery, near its origin at the lower edge of the sixth rib, posteriorly. In giving an opinion on the direction of this wound, one medical witness described the wound behind as being six inches below the level of that in front. As the small canal through the lungs could not be discovered, he was inclined to think that the two wounds could not be connected, because the gun had been discharged from the shoulder when the party firing was nearly on a level with the deceased. This opinion, however, was soon corrected by a reference to the anatomical relations of the parties of the thorax. Indeed, it will be found that a straight line carried backwards from between the first and second ribs in front will, in a well-formed skeleton, touch the upper border of the fifth rib posteriorly ; therefore this wound was nearly *horizontal*—being only one inch and a quarter lower posteriorly than anteriorly. In the case of Colonel Fawcett, killed in a duel, the bullet entered on the right side of the chest, fracturing the *seventh* rib, and after traversing the posterior part of the lungs lodged in the *ninth* dorsal vertebra. These parts are in a line with each other, and the wound was horizontal.

It must not be forgotten that a wound immediately below the sternum will in its fore part involve the viscera of the abdomen, in the back part those of the chest, and in its central part it will traverse the diaphragm.

When attempting to deduce the position of the assailant from the direction of the wounds, the observer must always keep in mind the possibility of the body having been in an abnormal position at the time of fire, thus a person stooping may be shot in the back with the direction of the wound from above downwards by a person standing in front of him.

When a bullet traverses the body it sometimes happens that the two apertures are opposite to each other, although the bullet may not have taken a rectilinear course between them, but have been variously deflected by the subjacent soft parts. This deflection of a projectile from a rectilinear course is met with in those cases in which it strikes obliquely a curved surface, and it is found that when it enters and does not pass out its course is often circuitous, so that it is not always easy to say in what part of the body it will be found.

Once Taylor saw a boy who had received a firearm wound in the upper part of the abdomen ; the entrance orifice was plainly situated there, but there was an opening at the back, nearly diametrically opposite, out of which the ball had passed, so that it conveyed the impression that the ball had completely traversed the abdominal cavity. There was, however, no sign of collapse or depression, nor any indication of serious injury ; and Dupuytren gave an opinion, which was afterwards verified, that the ball had not penetrated, but had been deflected beneath the skin, and had taken a circuitous course through the cellular tissue to the back. Abernethy was called to examine a man who had shot himself through the head. He found two openings in the scalp, nearly opposite to each other. It was soon perceived that the ball had not penetrated the bone, but had followed the curve of the exterior of the skull to its point of exit.

The deflection of projectiles may occur not merely when they come in contact with bone, but when they meet skin, muscles, tendons or, membranes ; the bullet then takes its course in the spaces between these different structures. A bullet which entered at the ankle has been known to make its exit at the knee ; and another, which entered at the back of the left shoulder, passed around the inside of the scapula and was found below the right ear. This deflection of a bullet by slight obstacles has been ascribed partly to the obliquity with which it strikes, and partly to the rotary motion on its axis. The same deviation has been found to occur when the bullet was fired near or at a distance provided that it was fired from an old-fashioned firearm, or was a rounded missile. The modern small-bore rifle bullet has a much greater tendency to preserve its course, though there are many published cases which indicate that deflections are frequent.

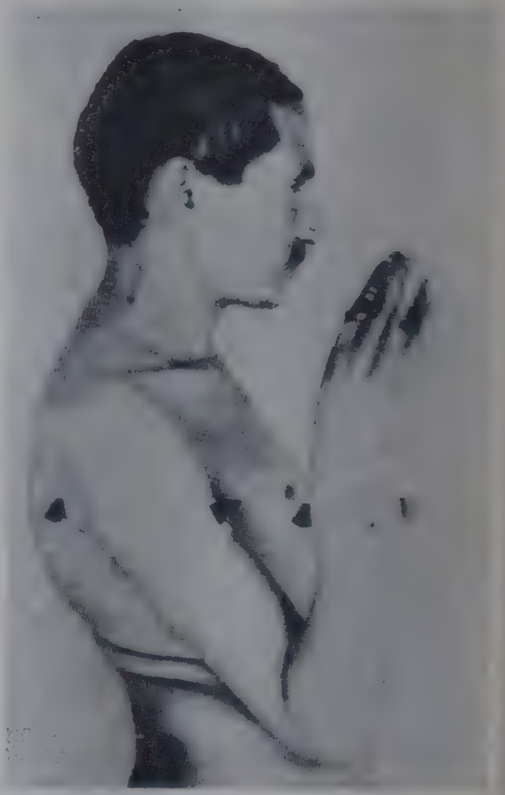

Fig. 39.—Photograph to show the position of the victim at the moment of fire with arrow heads to show the position of the skin wounds.

When a bullet from a high velocity weapon disintegrates the constituent particles are commonly deflected from the normal line.

Evidence from Several Wounds. When several wounds are found on a body, can we determine whether they were produced by one or several different discharges, or how they were produced ? This question was raised in a case in which there were two wounds on the deceased, and the accused alleged that only one pistol had been discharged. One bullet may sometimes produce several wounds on the body. If the bullet splits up within the body and divides itself into three or four pieces, there will be only one orifice of entrance, but possibly several orifices of exit. This splitting of a bullet has repeatedly occurred when the projectile in its course has encountered an angular surface, or a projecting ridge of bone.

Dupuytren met with an instance in which a bullet, after having struck the ridge of the bone of the leg (tibia), divided into two parts, which traversed the calf of one leg, and penetrated into the calf of the opposite leg. Thus no fewer than five wounds were produced in one instance by a single bullet—three of entrance and two of exit. A similar effect was observed in a case in which the bullet struck the parietal bone of the head and divided into two portions: One passed out superficially through the skin; the other penetrated into the brain, and lodged on the tentorium.

Such cases show that the discovery of an exit aperture does not always prove that the whole of a projectile has passed out—a matter which may influence a medical opinion as to the result.

Fig. 39 illustrates a case in which one discharge caused fracture of both bones of the forearm, fracture of the upper third of the humerus and an injury to the tissues of the chest wall. The shot was fired at the moment when the victim was raising his right arm. Figs. 40 and 41 show the extent of the injuries to the bones.

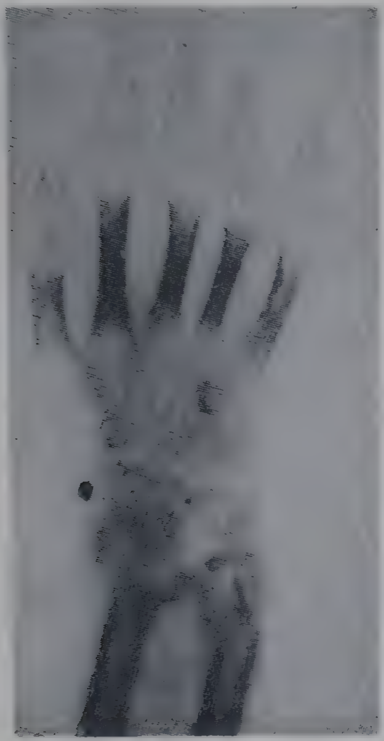

Fig. 40—X-ray photograph of the wrist showing the damage caused to both bones of the forearm.

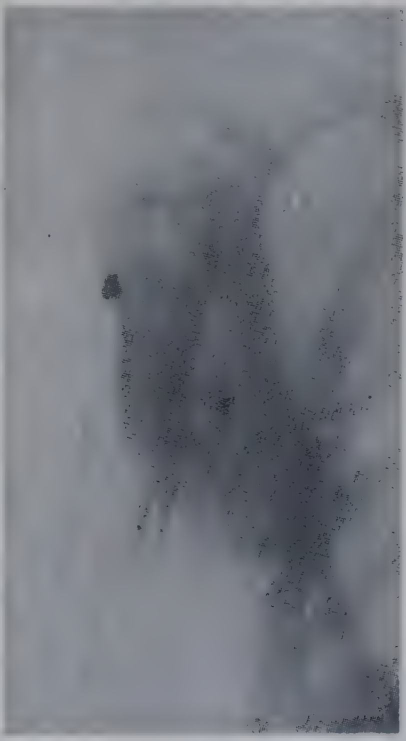

Fig. 41.—X-ray of the arm and chest wall of the same case.

Several wounds are commonly produced also by small-shot, but it must not be forgotten that small shot may, when fired at very close range, produce only one entrance wound. For further details and discussion, *vide ante*, " At what Distance was the Weapon Discharged ? "

The following case indicates how the presence of several wounds on the elbow showed conclusively how the shot was fired :—

Two children, a boy and a girl, were by themselves in a workshop where a loaded gun was kept; the boy was five, the girl a little older; the gun was heard to go off, and the little girl came running out of the shop. The gun was found on the floor some six feet or more away from the boy, who lay dead on the floor; the muzzle was towards him and the butt away from him. No reliance at all could be placed on the girl's story, which was coloured by fright and fear of the consequences of what she might say. Suicide and deliberate homicide were out of the question, and it was left to the medical evidence to clear up how the girl had accidentally shot the boy. Autopsy revealed some half-dozen small wounds made by the shot above the right elbow, entering just below the right elbow and running obliquely through the muscles up towards the upper arm; also a very large jagged wound in the neck just below the jaw, shattering the second and third cervical vertebræ, in which were lodged a large number of shot. Collectively these wounds showed conclusively that the girl must have pointed the gun at her little brother; that he in alarm put up his right arm in a bent position to shield himself; the girl had then pulled the trigger, probably quite unintentionally, and the elbow being a little out of the direct line of the bulk of the charge had received only a few pellets, the greater portion going under the arm and catching the neck. The girl had probably only about sufficient strength to hold the gun not quite to the shoulder, but being taller than the boy, the shot had taken a practically horizontal direction in him. Entire absence of marks of powder, coupled with the balling of the shot, showed that the shot was probably fired about two feet or a little more from the boy's head. Measurements of the scene of the occurrence closely corroborated this view.

In *R.* v. *Dowell* the direction of fire was shown very definitely.

The medical evidence was to the effect that the prosecutor had two wounds in front of his chest, one just above the seventh rib and one in the middle line—both wounds tracked under the skin, the upper one for about two inches and the lower one for about four inches—the bullets were just under the skin, and were removed the same day—the wounds are now practically healed—they were both in dangerous positions—they did not strike with great force.

Both bullets went in an upwards direction after entering the body, and are *consistent with* the view that the person who held the revolver was on the ground.

For a case of multiple wounds from one discharge, *vide Lancet*, 1909, 1, p. 1576, reported by Dr. R. Knowles.

WAS IT ACCIDENT, SUICIDE, OR HOMICIDE?

The reader is referred to pp. 313 *et seq.*, where the same question is discussed in reference to wounds of an ordinary character. In gunshot wounds the evidence is derived from the same sources, but it is in some respect more definite in its indications, one reason being that the nature of the weapon is fairly obvious.

The following case from previous editions of this work is well worth insertion as a special demonstration of the difficulties in deciding the point, and how they may be rendered insuperable.

R. v. *Smith.*—It appeared that the deceased was found dead in a field on the morning of November 20th. The body was lying at full length on its left side in a ditch. There was a blackened wound or hole in, and a little blood on, the cheek. A pistol was lying on the ground about four feet from the head of the deceased. The time at which the deceased died was fixed with tolerable precision at twenty-five minutes before eight o'clock on the evening of November 19th; the prisoner had had an opportunity of being on the spot at the time when the discharge of a pistol was heard. The defence was that this was an act of suicide. The pistol could not be identified as belonging to the prisoner; and one witness for the defence gave evidence that, six years before, he had sold to the deceased a pistol resembling that found near the body. Upon this statement, and upon the failure of the medical evidence to throw any light upon the important question of homicide or suicide, the prisoner was discharged on the Scottish verdict of "Not Proven."

It was proved that the deceased had died from a pistol-shot, the bullet having penetrated the brain. From the features of the wound, one witness thought that the muzzle of the pistol when discharged must have been within from three to twelve inches of the face. He admitted that, as an act of suicide, the body might have assumed the position in which it was found, but that the probabilities were against it. The other witness thought that the pistol when discharged might have been twelve or thirteen inches from the face; and although a person standing could have made the wound that appeared on the cheek, yet a suicide would probably have made more sure of his aim by selecting another position. The only information regarding the wound was, that it was in the right cheek, below the malar prominence; that the opening was blackened, and the nose scorched with gunpowder, It appears that the medical witnesses did not see the body until after the lapse of *two days.* It had in fact been removed from the spot, washed, dressed in grave-clothes, and put into a coffin, before they saw it. The situation of the wound—*i.e.*, below the malar prominence in the cheek—is rather unusual for an act of suicide, but it was such as a murderer walking by the side of the deceased could have easily selected. The position of the pistol with respect to the dead body is inconsistent with the supposition that deceased had thus fallen accidentally after having himself discharged the pistol. There was no motive for suicide, and no reason why, had suicide been contemplated, the deceased should have selected the prisoner's field for perpetrating the act. Every fact tended to prove that this was an act of homicide, and not of suicide, the accused had the motive, means, and opportunity for committing the crime, but there were no circumstances which could directly connect him with it. The early interference with the body, and the neglect to call for a medical investigation, probably led to the obliteration of parts of the evidence which would have clearly satisfied the jury that this could not have been an act of suicide.

Evidence may be obtained :—

From the situation of the wound or wounds;
From the design;
From the distance from which the weapon was fired;
From the position of the weapon when found after death;
From the direction of the wound;
From the nature of the projectile, powder, wadding, etc.

Evidence from the Situation. Suicidal wounds from firearms are almost always directed to what is considered a vital part. The most common situation for a right-handed suicide to select is in the right temple. This site is chosen in about 80 per cent. of suicides. The forehead comes the next in frequency. Wounds of the heart are comparatively rare It is not, however, to be at once assumed that such situations negative homicide, for a murderer would naturally try to strike the same points. Other factors, such as the nearness of the weapon, must be considered. There is, however, one situation which it is almost impossible for a murderer to imitate, and that is inside the mouth. It is true that a man might be so stupefied with drink or sleep, etc., or a child might be so frightened, as to allow a murderer to place the muzzle of the weapon within the mouth, but there would very likely be evidence of this. Wounds of the medulla or brain are especially liable to be followed by instantaneous cadaveric rigidity, and it is common to find the weapon strongly grasped in the hand of the suicide.

Again, unless elaborate preparations for suicide (strings, sticks, etc., attached to the trigger) have been made, it is very rare indeed, though not absolutely impossible, for a suicide to shoot himself from behind. Moreover, except in the head, the laity would not know where at the back to inflict a fatal wound. Hence it is very important to ascertain the point of entrance of a missile (*vide* Miss Holland's case, *ante*, where this was possible). If the missile still remains in the body, this is, of course, easy; if it has passed completely through there may be a little more difficulty.

In the following case of attempted suicide the characters of the wound somewhat resembled those which are commonly imputed to homicide :—

A man was taken to Guy's Hospital with a large ragged gunshot wound on the right side of the head, behind the angle of the jaw, and between it and the ear. No slugs or bullet could be found; the direction was from behind forwards and from above downwards. According to this man's statement, the pistol missed fire three times, but he succeeded in discharging it into his mouth at the fourth attempt. He lost a large quantity of blood, but after some time he walked to a table at a distance of five yards, reloaded the pistol, and discharged it at the back of the head in the situation described. Thus, then, there were in this case two wounds, one of them being apparently homicidal in its characters; and there was a power of locomotion after the first wound in spite of great loss of blood.

Evidence from Design. In suicide there is commonly strong evidence of design; in accident all evidence of design is wanting. Suicides sometimes make use of unusual weapons, or use weapons in an extraordinary manner.

In a case that was brought into St. Thomas's Hospital, a young man for the purpose of shooting himself, used the case of an Italian iron, in which he had filed a touch-hole. He used a marble for a bullet, and discharged the piece into his mouth.

Guns are less commonly used by suicides, and when they are employed the marks of design are usually evident; thus the gun is perhaps found to have been discharged by a piece of string attached to the trigger and connected with the deceased's foot. In one instance a man loaded a gun and placed the stock and breech in a grate. He then deliberately lighted a fire in the grate and sat opposite to the muzzle.

The following case is interesting from the evidence of design in the murderer's suicide :—

An inquest was held in Devonshire, on H. Baker and Alb. Corner the latter having shot the former and then committed suicide with the same gun. The murderer fired two shots at his victim. The first shot smashed the upper and lower jaws. The second shot went through his right arm and shoulder joint. It was the first wound that caused death. Corner was afterwards found in a field, with the right side of his face blown away, he having committed suicide. Corner had been bitten by a viper nine years previously, and on the anniversary of that day he was affected in a strange manner. The jury found that Corner murdered Baker and then committed suicide, being in his right mind at the time. The murderer ran away and cut a stick from the hedge, placed it in the trigger, and, pointing the gun towards his head, released the trigger with the aid of his foot, the full charge entering his head and causing immediate death.

Evidence from the Proximity of the Weapon when Fired. Self-inflicted *accidental* gunshot wounds bear the characters of near wounds as a rule (*vide* p. 440 *et seq.*); they may touch vital parts, but if the body has not been disturbed the presence or absence of design in the infliction of a wound is commonly made apparent by the relative position of the body and the weapon. Such an injury may occur when a person is cleaning a gun or pistol with the muzzle pointed towards him, and the wound is then situated in front; or it may be produced by a person pulling a loaded gun towards him through a hedge or dragging it after him. In the latter case the wound is behind, and it may strongly resemble a homicidal wound, although the circumstances in which the body is found generally suffice to explain the matter.

If a near wound be inflicted by a second person it is impossible, in the absence of evidence, to say whether it was accidental or homicidal. It is very necessary in such cases to compare the particulars of the wound very carefully with the statements made by the person implicated; they may be such as to contradict in a most definite manner the evidence thus offered.

The same nearness of the weapon will be found in the case of suicides, unless there is evidence of special design, such as a long string or stick; the wound is almost sure to be ragged and blackened or peppered with fragments of powder, etc. In the following case the reason for acquittal is not very clear, having regard to the evidence that the wound was not a near wound :—

R. v. *Wilson.*—A medical student was charged with shooting at his father, a medical man, with intent to murder him. The prosecutor was lying asleep on a sofa in the evening, when he was suddenly awakened by a report of firearms and the sensation of an acute burning pain in the eye. This was followed by another report. A bullet was subsequently extracted from the eye, and another from the head. He fell off the sofa, and in raising himself up found a revolver on the floor at a short distance in advance of him. The prisoner had shortly before this gone downstairs in the direction of the room where his father was lying asleep. The prisoner called to his sister, saying that his father had shot himself. The medical evidence clearly showed that this was not such a wound as would have been produced by an attempt at suicide. It had none of the features of a near wound. The prisoner was, however, acquitted of the charge.

In the following case a verdict of manslaughter was narrowly avoided :—

An inquest was held on the body of a young man. The deceased and a friend had been shooting together. According to the friend's evidence, the deceased got over a fence, and slipped in climbing a bank and thus shot himself. The marks of slipping, however, were made by an unnailed boot, whereas those of the deceased were heavily nailed, and the shots in and about his head were only thirty in number and distributed in a manner which could not have been caused by the firing of a gun with shot cartridges close at hand. The distribution of the shots was such as might have been caused by the firing of a gun at a distance of sixteen yards, at which distance the friend said he was when the accident happened. The verdict was to the effect that the deceased was accidentally shot by a gun not held by himself.

Proof of proximity is of very little value in evidence taken by itself; it must be weighed with all the other factors.

Evidence from the Position of the Weapon relative to the Body. Due allowance must be made for the unusual conditions in which the body of a person who has committed suicide by firearms may be found, otherwise erroneous suspicions of murderous interference may be formed.

A man was found dead on the floor of his bedroom, his body stretched out at full length, and both arms lying straight close to the sides of the body. A pistol-case was at a short distance from his right hand, and the left was gently closed on a piece of burnt paper without any blood on it, and the insides of the fingers were blackened. The pistol was lying near the *left* hand. On the right temple there was a wound, completely traversing the head, and having the features of an entrance wound. Portions of brain and blood had been carried to the furniture beyond the body. A conical bullet was found within the fender, resembling those in the pistol-case. This appeared to be an act of suicide. The discharge of the pistol was heard in an adjoining room by a servant, who stated that she heard the man speak immediately after the discharge of the pistol. If the pistol had been discharged with the right hand, then how did it happen that the pistol was lying near the left hand on the left side of the body, while the right arm was stretched at full length on the right side of the body? It is probable that the man shot himself with his right hand while sitting on the floor, that the pistol dropped on his left side, and that he fell flat on his back, retaining sufficient power to place his arms by the sides of his body. The burnt paper and the blackening of the fingers remain to be explained. The left hand must have been held near the pistol when it was discharged.

In these cases, as in cases of murder, there are many mysteries which can only be unravelled by the person committing the crime. Such a case as the above might have easily given rise to a charge of murder. The case of Risk Allah will furnish an additional illustration.

A young man named Readly was found dead in his bed. Readly was subject to epileptic fits. Risk Allah had insured the deceased's life for 1,000*l.*, but that was in order to cover a loan which he had made to him. The facts, as they transpired from an official inquiry, were these: One morning the deceased had an epileptic fit, and Risk Allah, a medical man, having attended to him, left him to sleep. At seven o'clock on that morning the chambermaid had gone into the deceased's room and had seen him asleep. At 7.30 Risk Allah came downstairs, went out, returning just before nine o'clock, when the landlord said that, as they had neither seen or neard anything of Readly since his fit, Risk Allah had better go and see how he was. The bedroom door was found fastened on the inside, and there was a strong smell of gunpowder smoke issuing from the keyhole. The door was broken open, and it was found on entering that furniture had been placed against it, and the room was full of smoke. A table and chair were found overturned. The deceased was lying on the bed, shot through the head. The body was naked, the night-dress which he had worn being in another part of the room, without any stains of blood upon it. Blood was still flowing from the wound, and one of the hands was warm. The right arm was across his stomach, and the left arm by his side. A recently discharged gun and a ramrod were on the floor by the side of the bed, and there was a chair close by, which had been overturned. Some shots were also found. On a table in the room was a piece of paper on which were written, in the handwriting of the deceased, the words "I have done it," the ink being still *wet.* The question was raised whether this was an act of murder or suicide. Risk Allah was discharged, and the act was pronounced to be one of suicide. Three years afterwards the whole case was gone into again in this country, on the occasion of an action for libel, in which the writer substantially charged Risk Allah with the murder of his companion, and a verdict, with heavy damages, was returned for the plaintiff.[1]

The position and attitude of the dead body were considered by some medical men to be inconsistent with suicide. One said that after a severe gunshot wound like this, involving the brain, it would be impossible for a person to place his arms by the sides of the body or to put his hands under the bedclothes. Another contended that a man could not possibly shoot himself with a gun while lying down in bed; but both of these propositions are contrary to fact. It was also proved that the wound in the body had the usual appearances of a near wound, which would be the result of a gun so fired. In short, there was nothing in the *medical* circumstances of this case which justified the charge of murder.

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[1] *Risk Allah* v. *Whitchurch*, Q.B., June, 1868.

In relying upon the relative position to the deceased of a discharged gun or pistol, an expert, unless he has had a large experience in such subjects, may be easily deceived, and draw a false conclusion.

A gentleman was out shooting with a double-barrelled gun. He had just put on the percussion-cap, and was holding the gun loosely in his hands, when the right barrel went off. From the recoil, with nothing behind the butt, the gun flew back a yard or two behind him, and the cap of the left barrel came so sharply in contact with the hard ground that it also exploded, sending the charge into the outside of the sportsman's thigh. The shot passed through the right-hand pocket of his shooting-jacket, striking his shot-bag, and driving the brass top into the muscles behind the hip-joint. The metal head of the shot-bag deflected the charge, so that it passed round outside the thigh and lodged in the muscles. This deflection probably saved his life, as no great vessel was wounded.

Assuming that the man had been found dead in these circumstances, it might have been said that suicide and accident were impossible, that no man could have shot himself with a gun from behind in the manner described, and that the position of the gun, one or two yards behind the body, could only be explained on the supposition that someone had shot the deceased from behind.

In *R.* v. *Adams*, the prisoner was charged with the murder of his father; the gunshot wound which had caused death was situated at the back of the head. No weapon was found near; hence there could be no doubt that this was an act of murder. The prisoner was acquitted, since, although he was seen running from the spot at or about the time of the murder, another gun was heard to be discharged from the same spot about an hour afterwards; and it was impossible, from a medical examination of the wound to say at what particular time it had been caused. *R.* v. *Richards* was a somewhat similar case. The deceased was found dead, lying on his back, with his gun placed on the front of his body, reaching from his thigh to some inches above his head. On inspection it was ascertained that death had been caused by a gunshot wound at the back of the right ear. Two surgeons gave it as their opinion that from the position of the wound, the body, and the weapon, death could not have occurred from design or accident on the part of the deceased, but might have taken place from the accident of another. The prisoner was acquitted, as there was insufficient proof to connect him with the act.

There is, however, one position in which a weapon may be, which admits of very positive deductions, that is when the weapon is still *firmly* grasped in the hand of the dead man. This position proves most positively that, if the fatal bullet was fired by that weapon, the dead person fired the fatal shot himself (*vide* "Cadaveric Spasm"), but it does not of course prove whether he did it accidentally or intentionally; that must be left to other evidence to prove. The point may be extremely important, say for insurance purposes, and medical evidence of design may clear it up, but otherwise medical evidence alone is powerless.

The absence of the weapon was of importance in the following case:—

The dead body of a young man was lying on its right side, with blood on the pillows and sheet near his head. His face was discoloured, and *rigor mortis* was present. There was a small round wound behind his left ear, from which blood and brain substance had oozed, and a wound an inch and a half long in his right forehead, with bruised edges, which reached to the bone. No pistol or weapon of any kind was found near the body, but a pistol, cartridges, and an old hammer, stained with what appeared to be blood, were found concealed in a box in another room. At the *post-mortem* examination, on reflecting the scalp, a large amount of extravascated blood was found extending from the wound on the forehead to the occiput, and fractures extending through the frontal, temporal, parietal, and occipital bones. A flattened bullet, which had entered the skull by the wound behind the left ear, had left its track through the posterior lobe of the brain and the cerebellum, and was found an inch and a half above and behind the right ear, where it had fractured the bone, but was lying within it. The conclusions arrived at were—(*a*) that the bullet wound or the other injuries to the head were either of them sufficient to have caused death; (*b*) that the wounds could not have been self-inflicted; (*c*) that the bullet wound was the immediate cause of death. At the inquest a verdict of wilful murder against the deceased's brother was returned, but at the Old Bailey he was acquitted on the ground of insanity.

Evidence from Direction of the Wound. The course taken by small-shot, when discharged at short distances, may indicate the direction in which the discharge took place, and thus aid in the identification of the assailant. In *R.* v. *Marris* it was a question whether the wound indicated the direction in which the gun was fired. The deceased was shot while passing along a public path. If the prisoner were guilty, he must have fired the gun from a window more than twelve feet above the ground. According to the evidence, the shot must have been fired downwards. It had blown away the upper lip, the teeth, and lower jaw. The prisoner was convicted.

In the following case the direction in which the bullet (taken with its nature) struck deceased was a strong point in suggesting accident.

In January, 1904, an inquest was held by the East Cumberland coroner at Glassonby on the body of Mr. William Edwin Rowley. James Wilson, valet to deceased, said he left his master at half-past one on Thursday morning in the study. He had been drinking sherry, but was quite sober. At eight o'clock the same morning he found his master lying on the floor with a severe wound in his head. Deceased had not been in bed, and was still dressed in pyjamas and a coat. When witness went to bed a double-barrelled express rifle was in a cupboard. The gun had not been used by deceased previously, having just come from London. He did not know if it were loaded when he brought it into the house. He thought the gun had slipped and struck the fender, causing it to discharge. The bullet was explosive, and one of the kind deceased had used for killing big game in India. Dr. Winship said his opinion was that the explosion was quite accidental. The expanding bullet struck the top part of the deceased's head, whereas if Mr. Rowley had fired his face would have been shattered. The jury returned a verdict of accidental death.

In the following case the medical evidence appears to be unduly didactic in many details.

At the celebrated trial of the brothers Peltzer for the murder of M. Bernays several important questions relative to hæmorrhage from gunshot wounds, the position of the assailant, and the production of cadaveric lividities, were raised. Bernays was inveigled into a room in a house in Brussels, specially prepared for the purpose; and as he crossed the threshold it is supposed that Léon Peltzer presented a pistol near the nape of the neck, and shot his victim dead. The body was no doubt subsequently disposed of by the brothers in the following manner. All traces of blood were removed from the room except in one spot, where there was a pool of blood weighing about nine ounces; and the body was placed in an arm-chair so that it might be supposed that death was the result of either suicide or accident. About a week later, information was conveyed to the authorities by letter that Bernays had been shot accidentally by one Vaughan—an assumed name of Léon—during an altercation; and this letter led to the discovery of the deceased's body. A judicial and medical examination of the body was made on January 18th, eleven days after the death. Stienon, who made the medical examination, said there were two wounds, one on the right temple, of a simple nature, the other in the nape of the neck, which had been the cause of death. This was a perfectly clean wound, without any burn. The ball had gone through the neck from left to right, slightly ascending and perforating the skull. The principal part of the projectile was found in the right temporal (middle) lobe of the brain. On the body were stains of blood and cadaveric lividities. The blood stains were in the nape of the neck and on the right side of the head. There were lividities on the right leg and forearm. The wound in the nape of the neck could not have bled much externally. The bleeding had been internal, and through the nose. There was little blood on the clothes of the deceased. A spot on the carpet contained nine ounces of blood; there was a footprint in this spot not produced by the deceased. Experiments made for the purpose showed that the footprint could not have been produced earlier than two hours and a half after the blood had flowed on to the carpet, and probably it was twenty or twenty-five hours afterwards. It was certain that the footprint was not produced on January 18th, the day of the first investigation at the house, and eleven days after the death. Experiments showed that cadaveric lividities could no longer be displaced when the body had remained in the same position for twenty-eight or thirty hours; therefore the body could not have become cold in the same position as that in which it was found. It might have been moved after twenty-eight or thirty hours, but the cadaveric rigidity must be taken into consideration. The body must have been rigid after twenty-four hours. Destruction of this rigidity was possible only by tearing the muscles, and no muscles were torn; therefore, it was probable that the moving of the body had been effected after cadaveric rigidity had disappeared, which usually happens after sixty or seventy hours. It followed that the body must have been moved some days after the crime. The blood on the carpet was irregular in shape, there being no blood in the centre; and the footprint was at the side. Death had doubtless been instantaneous; and experiments showed that the shot had been fired at a distance of four inches from the wound, though there was no blackening. Léon had indicated a spot where the shot was fired; but it was impossible that his victim could have been on that spot, as in that case the blood would have flowed all over his clothes, which was not the case. Bernays had evidently fallen against the corner of a writing-table, as was indicated by the wound on the temple, and had then rolled on to the floor. Probably the deceased was shot whilst stooping his head, as many do instinctively on entering a room. Inside, on the door, were some drops of blood, spurted on it when the wound was inflicted. The victim had bled through the nose for five or ten minutes after death. If the assassin had raised the head of Bernays, the blood would have flowed on to the clothes, which were free from blood. The footprint on the blood clot on the carpet had probably been made by a boot of Armand's, with which the mark corresponded. The body had not been moved sooner than from forty to sixty hours after death. This was the summary of Stienon's evidence; and he was confirmed by Vleminckx. For the defence, Guillery stated that what had been described as a footprint on the blood on the carpet had been produced by a knee, not a boot; and the impress might have been made ten or fifteen minutes after the blood had flowed. Hence it might have been produced, as Léon stated, when he knelt to raise the head of the deceased and to render him assistance. Cadaveric lividities, he asserted, permitted no conclusions to be drawn, as twelve days after death they were accompanied by putrefaction. The blood, he contended, had flowed from the nape, not from the nose. Schonfield confirmed this evidence. The brothers Peltzer were both convicted.[1]

Evidence from the Nature of the Projectile, Wad, etc. Useful evidence may sometimes be obtained by a careful examination of the projectile or any of the components of the discharge which may be found in the body, on the clothing or at the scene of the affair.

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[1] *B.M.J.*, 1883, I. p. 23.

Laboratory examination[1] of tissues from the wound or from the margins of the hole in the clothes may be helpful in determining whether the injury has in fact been caused by a firearm projectile, and whether it is the entrance or exit hole of the projectile. Certain information as to the distance from which the shot was fired and the angle of incidence of fire may be obtained, as well as some indication of the nature of the propellant and of the projectile.

Photography by infra red and ultra violet light may show the presence of a smoke halo and its distribution, even when nothing can be observed by the naked eye.

X-ray examination may show fragments of the missile and fragments of bone pointing in the direction of the discharge. Microscopic examination may show traces of the powder used, fragments of the missile, damage to or displacement of fibres or evidence of burning or singeing.

Micro-chemical and spectrographical examination may show the nature and distribution of residues such as nitrites and nitrates from smokeless powders; sulphides, sulphites, thiosulphates, thiocyanates, nitrates or carbonates from black powder. The presence of traces of lead, associated with such hardening substances as arsenic, antimony or tin, and less commonly with traces of copper, bismuth, sulphur, may indicate that an ordinary lead bullet has been used. Bullets which have a hard jacket, such as automatic pistol and rifle bullets, and occasionally revolver bullets, may leave traces of nickel, copper or zinc.

The older primer caps may leave traces of mercury fulminate and chlorate of potash, the newer types usually contain lead azide and barium, while antimony and occasionally tin or nickel may be found in either. The finding of one or other of these substances by microscopic and spectrographic methods must be interpreted with caution, and other parts of the clothing must be examined for purposes of control. It is obvious, however, that a careful laboratory examination of materials is likely to be of considerable value in any particular case.

The medical attendant should keep possession of any of the projectiles which he may remove from a wound, until he delivers them into the hands of a responsible officer.

Wads. In gunshot wounds, the examination of the wad or wads found in a wound or near a dead body has in more than one instance led to the detection of the person who had committed a crime. In old-fashioned muzzle-loading weapons the wad often consists of a portion of cloth or paper which may be identifiable. Handwriting has been traced on the paper used as wadding, or it has been found to have been part of a printed page, of which the remainder has been discovered in possession of a suspected person. When a gun is discharged near to the body, a portion of the wad is often carried into the large irregular wound which is produced. This was part of the evidence in the case of *R.* v. *Blagg* :—

> The peculiar nature of the wadding found in the body connected the prisoner with the act. In *R.* v. *Richardson,* the accused was convicted of murdering a policeman. Some paper wadding had been picked up on the spot where the deceased fell; and a gun which had one barrel loaded, and one empty from a recent discharge, was found in the prisoner's house within twenty four hours of

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[1] See Walker J. T., "American Journal of Police Science" mentioned in the "Journal of Criminal Law and Criminology" 31 : 497, 1940 for full bibliography.

the murder. The wadding in the loaded barrel consisted of a fragment of *The Times* newspaper of March 27th, 1854, and the charred and sulphurous pieces of wadding picked up on the spot were proved by the publisher of that journal, who gave evidence at the trial, to have formed a portion of the same impression. Though the explanation of the crime remained obscure to the last, and the motive unassignable, the aggregate evidence proved sufficient to convince the jury.

Such cases are now very rare indeed since the introduction of machine-made cartridges and wads. Anything found in a gunshot wound should nevertheless be preserved for evidence, for it may be necessary at a later date to compare such articles with articles seized in connection with the case. A wad, for example, may indicate whether a breech-loading or a muzzle-loading weapon was used, for in the former the wads are made from accurately cut circles of felt and cardboard. These will indicate the bore of the weapon, and may possibly give other information of value in identification.

Cartridge Cases.[1] If an automatic pistol was used, one or more cartridge cases will usually be found at the scene of the crime, and these are of more value than bullets for the identification of the weapon which fired them. When an automatic pistol is fired, the empty case is automatically thrown out of the chamber, and a new cartridge slides forward into its place. In this automatic charging and ejection of the cartridge, several things happen which leave their imprint on the cartridge case. The cartridge is forced up the magazine ; its nose is directed towards the chamber by means of metallic guides ; the breechblock strikes the base and forces it into the firing chamber. The firing-pin strikes the cap, and on the explosion taking place the breech-block moves backwards by gas pressure, the extractor hook catches the rim of the cartridge case, and it is pulled backwards with the sliding mechanism until it reaches a bar of metal jutting from the side of the slide. The cartridge case strikes this bar on the side opposite to the extractor hook, and as the hook continues its backward pull the case is thrown out. This occurs with a considerable amount of violence, and we may expect to find certain marks on the cartridge case from each operation, the extent of the marks depending on the violence of the operation. The empty case is therefore examined in detail under a low-power microscope, or with a watchmaker's eyeglass for any marks which may have resulted from these operations. On the surface there may be cuts or scratches caused by irregularities in the breech or in the slide ; these may be absolutely characteristic and imprinted on every cartridge, as may marks of various kinds imprinted on the base and cap from the breech block.

The mark of the extractor hook on the edge of the cartridge must be looked for. This varies considerably in cases fired consecutively from the same weapon, in depth, length, etc., but if a number of cartridges are fired the characteristic marks will become obvious. The surface of the base must be examined for the mark of the ejector bar, which often leaves a most characteristic depression. Finally, the position of the depression in the cap, whether central or to one side, and the character and depth of the depression, must be noted.

When a weapon is seized, it has to be decided whether the empty cases were fired from that particular weapon. After the preliminary examination, already described, a number of rounds are fired from the weapon, using several different brands of ammunition, including, if possible, several cartridges of the same make as the ones found. The weapon is fired into a roll of cotton-wool or rags (backed by a sandbag), the object being to obtain the bullets for comparison without distorting them, as well as the cartridge cases. The empty cases are collected and examined in detail, as outlined above, to observe whether any particular mark found on the seized case is reproduced on the fired cases.

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[1] From "The identification of firearms and projectiles," Sydney Smith, *B.M.J.*, January 2nd, 1926.

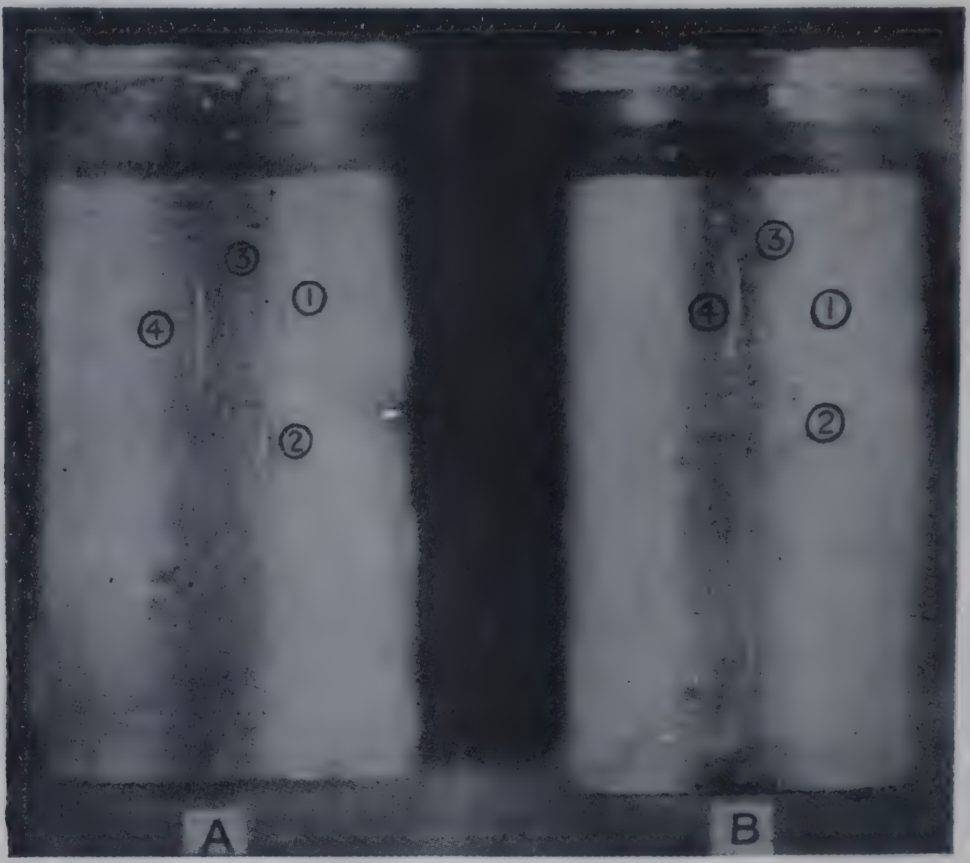

Fig. 42.—The empty cartridge case A was found at the scene of the crime. The cartridge case B was fired from an automatic pistol found in the possession of an accused person. The marks 1—4 are identical, and prove that both cartridge cases were fired from the same weapon.

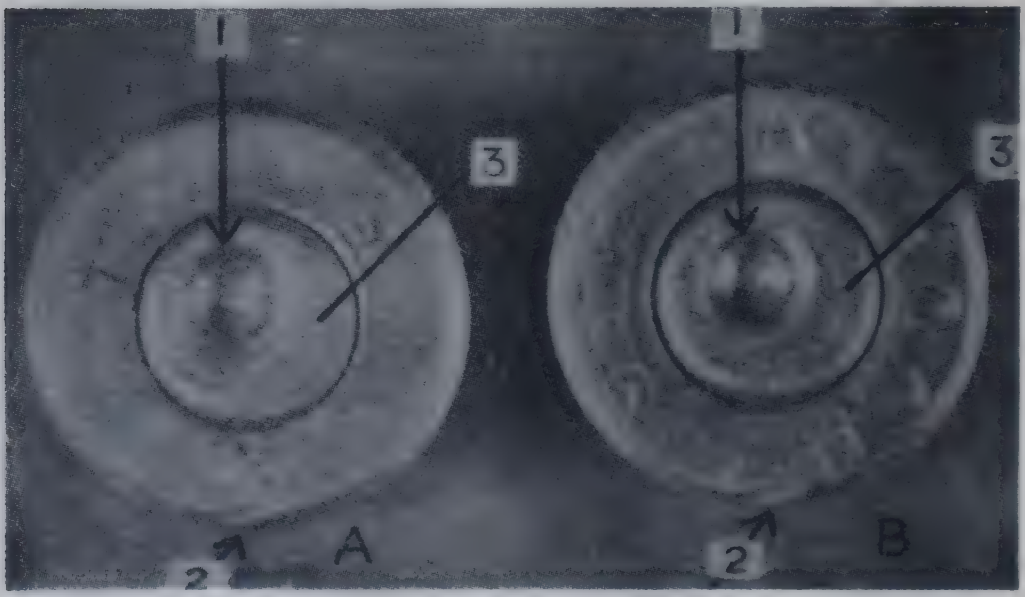

Fig. 43.—The base of the same cartridges figured in fig. 42 to show the same position of the depression caused by the firing-pin (1), the same mark of the ejector (2), and identical curved lines on the cap produced by ridges on the breech block (3).

The cartridges may be marked in such a characteristic manner that there can be no doubt of their identical origin, as in Figs. 42 and 43, in which there are scratches on the case of a particular kind, a definite extractor mark on the rim, and a firing-pin which strikes to one side. In other cases the marks may be absolutely different, and at once prove non-identity. A great many cases occur, however, in which the marks are ill-defined, and the matter becomes more difficult. In numbers of instances the marks from cases fired consecutively from the same pistol have no resemblance whatever, simply because they are ill-defined; they are, however, in the same position on the cartridge, and this must always lead the observer to make further experiments and obtain new samples.

It is never safe to say that a cartridge case was not fired from a given pistol unless the marks are quite different, and a case which bears no marks at all may quite well have been fired from the same pistol as one which leaves well-defined marks. In general, however, though it is unlikely that all marks will be equally good, it is usually possible to obtain definite information from the marks of the firing-pin, extractor, ejector, or breech-block on the base or rim, or from grooves or scratches on the surface. In weapons of the same manufacture, the marks are of the same general nature, but in each weapon there are individual differences which usually enable it to be definitely identified.

Bullets The cartridge cases having been examined, it is necessary to make a close comparison of bullets fired from the seized weapon with those found in connection with the crime. It is as well to fire half a dozen rounds from the weapon before it is cleaned, marking each bullet and placing it in the same position in the firing chamber. It is then cleaned and a further series of rounds fired, using, if possible, similar makes of cartridges and others of different make. The bullets are then collected, labelled, and examined in detail. The weight, length, and diameter are ascertained. The projectile is then fixed in some sort of an instrument which enables one to examine its surface under a low power, and at the same time to turn it round.

On every bullet fired from a pistol or revolver there will be found certain marks. The most prominent of these consist of a series of grooves, sloping either to right or left, which are caused by the lands in the barrel of the weapon. The number and direction of these grooves are first noted, the pitch is then ascertained, and the width of each groove and space between the grooves. In between the grooves and at different parts of the surface of a fired bullet there are found marks

A B

Fig. 44.—Bullet A was extracted from the body of a man murdered in 1920. Bullet B was fired from a Webley revolver (.455 inch) seized in 1926. The markings are identical, and indicate that the seized revolver was the weapon used in the crime

and scratches of various kinds. Some of these are caused by slight faults or patches of rust in the barrel; others are caused by metallic fouling. The former are constant; the latter vary from shot to shot. Each individual groove and space between grooves is now minutely examined under the microscope for some individuality. It is obvious that in weapons of the same manufacture the number, direction, width, depth, and pitch of the grooves will be the same, but in every weapon certain individual differences are usually to be found in one or more grooves. There may also be definite characteristic marks between the grooves.

It should also be clearly understood that a slight difference in calibre of the bullet and a difference in the charge of powder may make a considerable difference in the markings. If the diameter is slightly altered the smaller bullet passes through the barrel without definite grooves being cut into the surface, and even when bullets on measurement appear to be of the same diameter one will frequently be better marked than another.

In the *post-mortem* examination of the body of a person who has been killed by a discharge of small-shot, the pellets **do not always present a rounded appearance.** By the force of the discharge, especially when near to the body, or when any bony surface has been struck, the spherical form of the shot may be almost entirely lost. In *R.* v. *Evans*, an attempt was made to connect the prisoner with an act of murder by the appearance of the shot removed from the dead body. Some slips of lead, with small cut portions of the metal of a rough cubic form, were found in the prisoner's possession. A portion of the shot removed from the body of the deceased, who was found dead, had a similar cubical form. They consisted only of lead, but it was impossible to say that the lead was the same as that found in the possession of the prisoner. The evidence failed to connect the prisoner with the act. Cut lead, in the form of slugs, may be mixed with shot, and it appeared to be so in this case. In most manufactured shot there is arsenic or antimony. If this is found, it would tend to show that ordinary shot had been used.

Now and again serious and even fatal accidents are reported from the **toy pistols** sold with paper caps to children. Fragments of the cap have been removed from the eye after causing severe damage.

In *R.* v. *Czerzewski*, the evidence was that a woman (M. W.) and a man (C. K.), both Russian Jews, had been killed by pistol wounds. One witness said: "While we were all four," *i.e.*, two men and two women, "together in my room I heard some one running up the stairs shouting: 'All of you, come out; I'll shoot the lot of you.' Directly I heard this I put my knee to the door, which was already shut. Deceased put her shoulder to the door as well. Deceased advised me to get out of the way of the man. I could hear him get to the top of the stairs, and then there came two shots through the door, and then deceased fell down. Adèle held hold of her own arm and said: 'I've been shot through the arm.' Directly after the two shots were fired I was holding the door at the bottom with my knee. The man outside kicked the door and burst in. Directly he got into the room the man held the revolver he had in his hand under my chin. I caught hold of his wrist, twisted his hand round, and the revolver went off, wounding the man himself, grazing his forehead."

Several witnesses testified to the fact that four shots were fired altogether. The police produced the weapons seized from the prisoner at the time of the occurrence, with four chambers discharged and two undischarged, and also several loose cartidges, two picked up at the scene of the occurrence and some obtained from the prisoner's clothes and room, fitting the revolver.

Owing to discrepancies between the evidence of the police as to what they found on arrival and the evidence of other witnesses who were on the spot at the time, it became necessary to prove every step in the prosecution most carefully.

Dr. Oliver's evidence on the woman ran as follows :—" I viewed the body of deceased woman. She was lying on the floor at full length in the room, but the position of the body had been shifted. After removing the clothing, a wound was found in the left shoulder. I made a *post-mortem* examination of the body. On the front of the left upper arm, two inches and a half from the summit of the shoulder and one inch to the outer side of the anterior fold of the axilla, there was a punctured wound, and on the right side in the mid-axillary line on a line with the lower border of the right breast, nearly protruding through the skin, a foreign body was to be felt. An incision was made over the point, and the bullet produced was removed. The skin here for an area as large as a five-shilling piece was discoloured, and the tissues beneath infiltrated with blood. There were no other external marks of violence.

" The circular wound on the left shoulder was one-third of an inch in diameter with jagged inverted edges. On tracing this wound, it was found to pass through the soft structures forming the armpit, which were infiltrated with blood. It then entered the left chest by passing through and shattering the upper surface of the fourth rib just beneath the anterior fold of the axilla. It then passed through the left lung, the percardium, the aorta at its commencement, the right lung, and the upper surface of the eighth rib, shattering the latter, to the point previously described on the right side. The chest cavity and pericardium contained large quantities of blood clot. No disease in the lungs, and the other organs were healthy. The bodice worn at the time showed a perforation corresponding with that in the shoulder.

" In my opinion the cause of death was hæmorrhage from the lungs and aorta being traversed by a bullet.

" The bullet is apparently of the same size as that in the body of the man."

On the man Dr. Oliver gave evidence as follows :—" The dead man was lying on his back at the top of the stairs, with feet directed to the door of the room ; his head was resting on the top of the stairs immediately against the wall forming the back of the house. The position of the body was such that the right side of the body formed a curve, the convexity looking towards the wall of the passage.

" There was a wound in the left temple midway between the ear and the external angle of the left eye. There was vomit and blood on the passage floor.

" I made a *post-mortem* examination of the deceased. Both hands were bloodstained. Midway between the left ear and external angle of the left eye the skin was discoloured to about the extent of a penny-piece, and in the centre of this there was a circular punctured wound with inverted and jagged edges. This measured a quarter of an inch in diameter. There was no evidence of burning or discoloration by gunpowder. On reflecting skin a considerable effusion of blood was found among the contents of the temporal fossa. The zygomatic arch was shattered, and the temporal bone was shattered at a spot corresponding to the external wound. On removing the scalp, skull-cap and covering of the brain, a considerable quantity of blood escaped. The bones forming the middle fossa of the skull had been shattered, as had also the body of the sphenoid.

" *Brain.* The bullet produced was found within half an inch of the upper surface of the left brain, near the middle line, immediately above the shattered body of the sphenoid. The substance of the brain was torn up along the track the bullet took. There was bloody effusion into and upon the substance of the brain. There were numerous small spicules of bone adhering to the base of the brain. The direction taken by the bullet was from before and backwards across the base of the skull and very slightly upwards. The inclination was, however, very slight, and the direction was almost horizontal and directly across. From the puncture on temporal bone two small fractures were to be seen, one running slightly upwards and forwards towards the orbit, the other running backwards and inwards towards the middle line. Other organs healthy, no sign of disease.

" In my opinion the cause of death was shock from fractured skull and lacerated brain by means of a bullet. The bullet was not fired quite close to the deceased."

Dr. Oliver then deposed that he had weighed bullets taken from some undischarged cartridges (found by the police), and compared them with the weight of the bullets taken from the dead bodies. The difference was satisfactorily accounted for by fragments adhering to bones in each case.

The distance at which the shots were fired then became material to the case. Dr. Oliver deposed that he had found ingraining by gunpowder and scorching on the panel of the door through which two shots had passed. He made six experiments with the pistol and cartridges exactly like those used : (1) Touching a card, the card was very much scorched some two inches and a half round the bullet hole ; (2) at three inches still scorching and the card actually caught fire in a circle about two inches in diameter, and considerable ingraining of powder ; (3) at six inches still some scorching and much ingraining, the scorching less and the ingraining more than at three inches ; (4) at twelve inches no scorching, but still much ingraining ; (5) and (6) at eighteen inches and two feet still slight powder marks, at three and four feet no powder marks were obtained. He then experimented on a cadaver. The results corresponded precisely.

IDENTITY FROM THE FLASH OF GUNPOWDER

Among the singular questions which have arisen out of this subject is the following : whether the person who fires a gun or pistol at another during a dark night can be identified by means of the light produced in the discharge. This question was first referred to the Class of Physical Sciences in France in 1809, and they answered it in the negative. A case tending to show that their decision was erroneous was subsequently reported by Fodere. A woman positively swore that she saw the face of a person, who fired at another during the night, surrounded by a kind of glory, and that she was thereby enabled to identify the prisoner. This statement was confirmed by the deposition of the wounded person. Desgranges performed many experiments on this subject, and he concluded that on a dark night, and away from every source of light, the person who fired the gun might be identified within a moderate distance. If the flash were very strong, the smoke very dense, and the distance great, the person firing the piece could not be identified. The question was raised in the case of *R.* v. *White.*

A gentleman was shot at while driving home during a dark night ; and he was wounded in the elbow. When he observed the flash of the gun, he saw that the piece was levelled towards him, and the light of the flash enabled him to recognise at once the features of the accused. In cross-examination he said he was quite sure he could see the prisoner, and that he was not mistaken as to his identity. The accused was skilfully defended, and he was acquitted.

Evidence of this kind has, however, been received in an English court of law. *R.* v. *Stapley* was a similar case.

The prisoner shot at a gamekeeper, on a dark evening in December, and the latter said that he distinctly saw the prisoner by the flash of the gun, and could identify him by the light on his features. This evidence was corroborated by three other witnesses who saw him not far from the spot, and by one who saw him in the act of running away. He was convicted. In *R.* v. *Haines*, some police officers were shot at by a highwayman during a dark night. One of the officers distinctly saw, from the flash of the pistol, that the robber rode a dark brown horse of a remarkable shape in the head and shoulders, and the horse had since been identified at a stable in London. By the same flash of light it was seen that the person had on a rough brown great-coat. This evidence was considered to be satisfactory.

There is no doubt that occasionally an assailant may be thus identified. It is to be noted, however, that there is comparatively little flash with nitro-powder, and consequently little chance of identification of a person by the light produced by the discharge.

IMPUTED OR SELF-INFLICTED NON-FATAL FIREARM WOUNDS

Gun-shot wounds are sometimes voluntarily inflicted for the purpose of imputing murder or extorting charity. A man intending to commit suicide by firearms, and failing in the attempt, may also, from shame or a desire to conceal his act, attribute the wound to the hand of an assassin. In examining such imputed wounds they will be found to involve non-vital parts, except in cases of attempted suicide, and they will possess all the characters of near wounds. The skin around will be more or less lacerated and bruised ; there will be much ecchymosis and there will probably be traces of blackening, burning and impaction of powder particles in the skin. The hand holding the weapon, as well as the dress, may be blackened or burnt. A gun-shot wound from an assassin may be produced from a distance, while an imputed wound which is produced by a person on himself must always partake of the characters of a near wound. If the weapon has been charged with nitro-powder, there may be few marks of blackening or burning on the person or dress.

WHEN WAS THE FIREARM DISCHARGED ?

Many attempts have been made by medical jurists to determine at what period a gun or pistol may have been discharged ; but it is out of our power to lay down any precise rules on such a subject.

A chemical analysis of the products of decomposition in the gun-barrel, or of the particles of powder surrounding the wound in the body or the hole in the clothes, may give some information about the time at which the weapon was discharged and the nature of the powder used.

Black powder consists of an intimate mixture of charcoal, sulphur, and potassium or sodium nitrate (saltpetre). When this mixture explodes a considerable evolution of mixed gases takes place, the gases consisting of nitrogen, sulphuretted hydrogen, carbon dioxide, carbon monoxide and methane. This mixture of gases has a peculiar characteristic smell, which can be noticed for several hours after the discharge of a gun. In addition there is a formation of potassium sulphide and carbonate.

The sulphuretted hydrogen rapidly disappears, and the sulphides present becomes converted into thiosulphates, thiocyanates, and finally into sulphate of potassium.

From the point of view of ascertaining the time when the weapon was discharged, we know that for a few hours there is a smell of hydrogen sulphide, and, on chemical examination of the fouling, a reaction for sulphides will be obtained for five or six hours. Traces of thiocyanates and thiosulphates may be found at a very early stage, and these appear to increase for a few days. Sulphates are found only in traces for the first few days ; they then gradually increase, and as they increase there is a tendency for the thiosulphates and thiocyanates to diminish. Iron salts in the ferrous state are usually found in traces in the early stages, and gradually become converted into ferric salts.

The difficulty, however, in attempting to deduce the time of firing from the chemical examination of the products of decomposition, lies in the fact that the examiner does not know and cannot know whether the barrel was clean when the shot was fired.

Nitro-powders or smokeless powders, which are in common use for sporting guns and in almost universal use for rifles and automatic pistol ammunition, are usually composed of nitro-cellulose or nitro-glycerine. These substances on burning, leave traces of nitrates and nitrites which are not liable to undergo further changes by lapse of time. The solution obtained by washing out the barrel after firing smokeless powder is usually colourless, neutral, free from sulphides, and contains, as we have said, a quantity of nitrites and nitrates, which effectively distinguishes this type of powder from black powder.

The fouling of the barrel with smokeless powders is often dark in colour, but never has the black appearance seen after ordinary gunpowder.

CHAPTER XII

DEATH FROM LIGHTNING AND ELECTRICAL CURRENTS

Death by lightning is sufficiently common to require that a medical witness should be prepared to understand the phenomena which accompany it ; but there is a more important reason why he should devote some attention to this subject, viz., that the appearances left on the human body sometimes closely resemble those produced by great mechanical violence. Thus a person may be found dead in an open field, or in the highway ; his body may present the marks of contusion, laceration or fracture ; and to one unacquainted with the fact that such violence occasionally results from lightning, it might appear that the deceased had been maltreated and probably murdered. Deaths actually from lightning fluctuate very much according to the number and severity of thunderstorms ; deaths from electric currents vary from year to year, but on the whole, steadily increase owing to the enormous growth in the production of electricity for industrial purposes, and as there may be certain sequelæ of importance from the point of view of compensation, these injuries require careful study.

The Registrar-General for England and Wales reported ten deaths from lightning for the year 1940 (eight males and two females). In the same year there were 77 accidental deaths from electric currents (71 males and six females).

In the usual type of accidental contact with " live " wire or cable, an electric current of some hundreds or thousands of volts passes through the body, and may continue to do for an appreciable length of time. In general, it is true to say that the higher the voltage the greater the likelihood or even certainty of fatal effects, but many apparently paradoxical cases are recorded. Currents of voltage as low as 100, or even 65, have caused death, and those of 500-5,000 volts are usually fatal. On the other hand, a considerable number of cases have survived contact with 10,000 volts. No doubt in some of these cases there were circumstances present which caused an increased resistance, so reducing the effective amperage, and modifying the electrical effects, but the true explanation is probably to be found in the route chosen by the current in its passage through, or close to the body. It is generally considered that alternating current is more dangerous than direct or continuous, but, while there is some experimental evidence to support this opinion, it is by no means conclusive. For judicial electrocution in the United States, electrodes are attached to head and leg, and alternating currents of 2,300 and 550 volts are applied in succession for 7 and 52 seconds respectively, each being repeated once.[1] For the convulsion therapy now applied in certain serious mental disorders, 80-100 volts are commonly employed, the current being passed for about one fifth of a second, with the electrodes applied to the temporal regions of the head.

A flash of lightning is due to the passage from a thunder cloud to the earth of an electric current of enormous potential, amounting to many millions of volts. Along the track of the current, much energy is liberated, most of which is converted into heat. The diameter of the track is variable, but considerable, and the course pursued is erratic and not necessarily in the path of least resistance. Branching flashes are given off, particularly in the lower part of its passage, and the effects may therefore be distributed over a surface area of 100 ft. diameter or more.[2] Though lightning and more ordinary electric currents may therefore be considered as differing only in degree, it is not surprising, in view of the enormous energy involved, that bizarre disruptive effects occur more frequently in lightning accidents. The intense heat engendered by the flash may fuse metallic objects on the victim, or in the immediate neighbourhood. For the same reason, severe burns may be found. There may be evidence of severe disruptive effects on the tissues or on the clothing. Indeed, the clothing is frequently torn into shreds, and may be thrown to some distance from the body. Metals may be rendered magnetic.

Signs and Symptoms of Shock by Lightning or Electricity

In many cases, symptoms can hardly be said to exist, death being practically instantaneous, but in those who recover, many symptons are described as occurring at the time and immediately afterwards. As a rule, there is no sense of pain, and the person falls at once into a state of unconsciousness, which may last for a few minutes or several hours, rarely for days ; and very rarely he may be found in a state of suspended animation requiring prolonged artificial respiration.

In a fairly typical case which did not prove fatal, the victim, who was seen soon after the accident, displayed the following signs :—insensibility ; deep, slow and interrupted respirations ; entire relaxation of the muscular system ; the pulse soft and slow ; the pupils dilated, but sensitive to light.

A state of restlessness, irritability and excitement may ensue, with tremors and twitchings or severe convulsions. The following old description of a case which recovered, illustrates this latter point, and is of interest in view of the present use of shock therapy :—

> An hour and a half after the stroke, a healthy man lay completely unconscious, as if in a fit of apoplexy ; his pulse was below 60, full and hard ; his respiration snoring ; his pupils dilated and insensitive. There were frequent twitchings of the arms and hands, the thumbs were fixed and immovable, and the jaws firmly clenched. Severe spasms then came on, so that four men could scarcely hold the patient in bed, and his body was drawn to the left side. When these symptoms had abated, he was copiously bled ; cold was applied to the head, a blister to the nape of the neck, and mustard poultices to the legs. Stimulating injections and opium were also administered. In the course of twenty-four hours, consciousness slowly returned, and the man soon recovered completely. The only external

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[1] Hassin, G. B. Arch. Neurol. and Psychiatry. 1933 ; 30 ; 1046.

[2] Jex-Blake, A. J. E. Afr. Med. J. 1945, 22, 170.

injury discoverable was a red streak, as broad as a finger, which extended from the left temple over the neck and chest ; this disappeared completely in a few days.[1]

On recovering consciousness, there is usually a retrograde amnesia, which may be complete, or the victim may remember only a flash of light, the feeling of a blow, or some similar sensation. Headache and dizziness, noises in the ears, and visual disturbances may be complained of. Pupillary anomalies may be detected on examination, and there may be cyanosis and œdema of the limbs. Localised anæsthesia or paræsthesia may be experienced, or motor effects ranging from mild paresis to complete paralysis of one or more limbs. Severe results of this nature, and others such as blindness, deafness and loss of speech, are fairly common after lightning stroke, but usually clear up within hours or days, and are to be distinguished from the more persistent sequelæ discussed later.

The following description is of a case which illustrates a number of these signs and symptoms very well :—

A man was struck by lightning. Externally there was a burn upon the nape of the neck, where a metallic watch-guard rested ; and from the point where the current of electricity left the chain, the skin was blistered in a straight line down to the feet, and the hair of the pubes was scorched in its course. His intellect was confused, and his general condition was that of collapse. With the aid of stimulants, he became sufficiently restored to describe his feelings. There was paralysis of the lower extremities, with loss of sensibility (anæsthesia), and retention of urine. He was deaf, and complained of a noise in his ears like thunder ; he had some difficulty in articulating, pain in swallowing and a peculiar metallic taste in his mouth. The anæsthesia passed away in half an hour, but he did not completely recover the use of his limbs for four days ; the bladder was paralysed for twenty-four hours. The bowels were confined. All these symptoms gradually disappeared, excepting slight deafness ; and he was discharged convalescent.

Another consideration suggested by this case is the possible variations in the clinical picture which may be caused by the burning and disruptive effects of lightning. The local effects of currents are seen chiefly in the form of burns at the sites of entrance and exit of the current, and occasionally at the flextures of the bent limbs where it has jumped across. Whenever there has been any sparking, burns to the first or second degree, and occasionally to the third, may be found. These are characterised by dryness, insensitiveness, and anæmia, due to coagulative necrosis. Shedding of the superficial layers of the skin is common, and this may be found attached to the conductor.

Wrinkling of the skin may also be found, and occasionally localised œdema of a limb. After a variable latent stage, aseptic necrosis is apt to occur without any general manifestations. This necrosis often extends beyond the burn in area and depth, and may lead to spontaneous amputation.

In addition to the burns, there may be at the site of entrance and exit of the current, a number of greyish-white circular spots, which are firm to the touch, and are free from the zone of inflammation found in burns. Skin and other tissues may be split and torn, and bones may be fractured.

Henderson, D. K., and others,[2] in a series of 260 patients treated by convulsion therapy, encountered four instances of compression

[1] Brit. and For. Med Rev. Oct 1842.

[2] Edinburgh Med. Jour. November 1943.

fracture of vertebræ, one case of fractured femur and several cases of dislocation of the jaw. Small ecchymoses or large bruises may be found.

In a certain number of cases of lightning stroke, peculiar aborescent markings are found on the skin, which have been likened in appearance to the morning frost on a pane of glass. These are not burns, but are said to be due to minute depositions of copper in the dermis.[1]

Metzdorff P.[2] describes a case of epilepsy occurring in a woman who was struck by lightning during a thunderstorm. She was unconscious for 10 minutes and recovered without any sign of paralysis or of burning. Eight days later, epileptic attacks commenced.

Treatment of Persons who have been Struck by Lightning or Shocked by Electricity

Most of the cases when seen will be either dead or require no treatment beyond artificial respiration and bodily and mental rest. Great care should be exercised in removing the victim from any live wire, otherwise a multiple tragedy may result.

Jellinek[3] considers that electric shocks cause only *apparent death* in the majority of cases, and advises that artificial respiration should be carried on for hours, and oxygen administered in every instance. He quotes the case of a workman at St. Denis, who was overwhelmed by a current of 4,500 volts and 75 milliamperes, which passed through his body for several minutes. He was apparently dead, but under artificial respiration he revived in two hours, and completely recovered except for certain burns.

The essentials in treatment of electric shock are—firstly, to extricate the victim from the current, and secondly, to treat the apparent death instantly and continuously by artificial respiration. Inhalation of oxygen mixed with 5 per cent. carbon dioxide is of value in many cases, and cardiac and respiratory stimulants may be required.

In regard to prophylaxis, the precautions suggested at the Paris Academy of Medicine, should be memorised: (1) Never to touch any part of an electric lighting or heating apparatus with wet hands; (2) never to handle any part of an electric lighting or heating apparatus while touching water taps or pipes, or any other metal which will make a good contact with earth; (3) to fix electric fittings as far as possible away from water fittings.

Sequelæ

As distinct from the many transient disabilities which may follow immediately upon shock from electric current or lightning, a variety of more persistent sequelæ have been described. Headaches and giddiness may recur over a long period. Insomnia and defective memory are not uncommon. Irritability and inability to concentrate are, perhaps, the most frequent of the subtle changes in personality which may be noted, and which occasionally develop into a true psychosis. Hysterical phenomena may persist over a long period. Permanent damage to the central nervous system may be manifested by increasing spasticity and weakness in the limbs, or progressive wasting of certain muscle groups, conditions clinically resembling disseminated sclerosis and progressive muscular atrophy respectively. Cerebral damage may result in hemiplegia, aphasia, deafness or epilepsy, and a slowly progressive cerebellar syndrome has been recorded.

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[1] Critchley, M. *Lancet*, 1935: 2: 1002.

[2] Klin. Med. Wschr. 1937: 2: 1255.

[3] Der Elektrische Unfall, 1925.

Post-Mortem Appearances in Death from Lightning or Electricity

Externally. The suddenness of death is such that the body sometimes preserves the attitude in which it was struck. The pupils are always widely dilated immediately after death. *Rigor mortis* is stated to be sometimes absent; but this probably varies with the nature and direction of the currents, *i.e.*, whether the core or side currents pass through a muscle or many muscles, disrupting it or them, for in many cases it has been observed to occur as usual (especially *vide* a case below, where it was still present eighty-eight hours after death).

Generally speaking, there are external marks of contusion and laceration about the spot where the electricity has entered or passed out ; sometimes a severe lacerated wound is found up to the extent of a wrenching out of a bone ; on other occasions there has been no wound or laceration, but an extensive ecchymosis, which, according to Meyer, is most commonly seen on the skin of the back. On the head, a rounded effusion may be present in the scalp, simulating the results of a blow, *e.g.*, by a hammer. In several instances there have been no marks of external violence, and it frequently happens that they are so slight as to require careful search. The wounds have commonly been lacerated punctures, like stabs produced by a blunt dagger. In the case of a person who was struck, but not killed, a deep wound was produced in one thigh, almost laying bare the femoral artery. This person was struck while in the act of opening an umbrella during a storm. Fractures of the bones have not been commonly observed, but they do occur, especially in accidents from lightning as opposed to industrial electricity. In one case the skull was severely fractured and the bones depressed. The burns, if produced by the current, are usually deep, but limited in area, but they are as commonly produced by the smouldering clothes or by fused metallic substances which have been on the person when struck by lightning. The greyish spots or arborescent markings, formerly described, may be found on the body after death.

On the other hand, it occasionally happens both in death from lightning and from electric currents, that nothing can be found either externally or internally to indicate the cause of death, a point to be noted when legal doubts arise concerning the question whether the individual was killed by electricity, or was dead before touching the wire. We have seen cases of death from lightning on which no lesions were found.

Internal Appearances. These present nothing that can be described as characteristic, unless in correspondence with some external marks. Most of the conditions which have been described, such as œdema of the brain or lungs, and extravasations in different organs, and are by no means characteristic of death from electricity. Occasionally, fragmentation of the muscle fibres of the heart has been found in such cases, but this condition, though it may account for death, is not characteristic of death from electricity. The blood is usually described as remaining fluid for a long time, and putrefaction is alleged to set in very early. but these are by no means peculiar to deaths from electricity. Extravasations of blood in the cranial cavity have been described, and also similar conditions in the chest and elsewhere in connection with damage done to the tissues overlying the part. It has been suggested that when such are found, they may be the result of violent muscular spasm caused by the shock and rise in blood pressure.[1]

Histological investigation has revealed hæmorrhages throughout the brain, but especially in the medulla, patchy chromatolysis of nerve cells, and dilatation of the perivascular spaces, especially in the brain stem and cervical part of the cord. In the peripheral nerves, fragmentation of the axons, ballooning and disintegration of the myelin sheaths, and infiltration with endothelial cells have been noted. After very severe injury, considerable areas of the brain and cord may be found swollen and softened. Such changes are by no means constant or characteristic, however, nor can they be considered as peculiar to shock by electricity. Indeed, even where electric current or lighting is known to have played a dominant role in the causation of death, it is difficult or impossible to separate those findings which are due to the electricity from those caused by the associated factors of heat, cerebral concussion, and perhaps subsequent toxæmia.[2]

In cases of death from shock therapy, small hæmorrhages and damage to minute cerebral vessels have been found, with some alterations in brain cells. These changes are not sufficient in themselves to explain death, and no doubt the physical changes which accompany convulsions in most cases and death in a few, are of an order not yet observable, even in the fatal cases.

Cause of Death from Electricity or Lightning

The actual effects of the passage of electric currents through the body are still incompletely understood, notwithstanding the numerous investigations into the cause of death from accidental contacts, judicial electrocution, and as a result of convulsive therapy.

In many cases, of course, the cause of death is obvious enough in the shape of destruction of the brain, or the tearing of a large vessel. But very often, in those killed instantaneously, and even in those who live a longer or shorter time and then die, no such gross injury can be found to account for death.

It is probable that electrical currents cause death in at least two distinct ways. When the potential is not very great, and the current traverses the body, there appears to be a direct action on the heart muscle or innervation, causing fibrillation for a short period, followed by stoppage. It has been suggested that increasing the current in such cases may cause the heart to resume its action.

With currents of high potential or of great magnitude, death is due to inhibition of the respiratory centre in the brain, and breathing ceases while the heart continues to beat.

The human body would be a good conductor of electricity, owing to its fluid and salt content, if it were not for the insulation afforded by the skin. But the resistance of the skin varies with its thickness and its dryness. A man bathed in moisture should form a much better conductor than one with a dry skin, and this theoretical point is borne out by the observation that the number of accidents varies directly with the meteorological conditions. Unfortunately, it is often stated that currents of 100 to 150 volts are harmless, while those of 200 and over are dangerous. This is incorrect, for death from currents of 50 volts, when acting under conditions of dampness, occurs by no means infrequently. At a session of the Paris Academy of Medicine, held on February 7th, 1921, it was pointed out that currents of low tension (200 volts or less) might cause cardiac arrest with fibrillary contractions. Two cases were quoted in which the victims while in a bath, touched in one case, an electric radiator with faulty insulation, in the other, a metal bell-pull into which there was a leakage of current. In a third case, a workman was electrocuted by a current of 135 volts from a handlamp while working in a boiler. In Switzerland during 1919, six deaths occurred from contact with ordinary hand-lamps, and during the war period 1914-1918, eleven fatal cases were reported in the German literature from the therapeutic application of a sinusoidal alternating current of 50 volts and under. Besides the strength, frequency and nature of the current, and the resistance opposed to it, the danger of any particular current is influenced by the following factors: (*a*) the site of entrance into the body, (*b*) the part traversed by the current, (*c*) the duration of the contact, (*d*) the size of the area under contact, (*e*) the physical condition of the individual (status lymphaticus increases the susceptibility), and (*f*) the psychic component. Expectation of a current diminishes its effect, while surprise increases it. An example of this factor is afforded by an engine-driver, who made a habit of catching hold of a 50-volt lamp with both hands, and letting go again, as a bet for a glass of beer. He repeated this as often as the beer was forthcoming, until one day he *accidentally* came into contact with the lamp under the same conditions, and collapsed dead on the floor.

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[1] Jones, L. *B.M.J.*, March 1895.

[2] Critchley, M. *Lancet*, 1934: 1: 68.

Lucus[1] quotes the case of a boy of fifteen years, who received a shock from a 10,000 volts main. He recovered consciousness, but his extremities were found to be pulseless and in a state of solid œdema. Gangrene took place, and the patient died on the ninth day.

The public supply of electricity in Great Britain has recently been developed by a system of overhead conductors carrying currents at a pressure of 132,000 volts. From these mains, the current is tapped and transformed into lower voltages as required by different localities. The presence of these pylons throughout the country has already led to many deaths, some by accident, and some apparently by design.

An extraordinary case occurred at Preston in 1933, in which a boy survived after making contact with one of the conductors. He climbed a pylon, and when on a platform about 200 feet from the ground, a sheet of flame was noticed, and the youth was knocked over. His clothing was burnt off, and his skin badly burnt, but nevertheless, he was able to climb to the ground without assistance. He was taken into hospital and appeared to be making a good recovery from the shock, but toxæmia and pneumonia supervened from which the youth died about a fortnight after the accident.

It cannot be conceived that a current of 132,000 volts could have passed through his body without causing death. It is probable that as he approached the conductor, he altered the conditions in the vicinity and caused a spark to jump, the flame of the arc causing the burns.

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[1] "Clinical Transactions," 1905.

Jellinek has pointed out that the susceptibility to electrical currents varies considerably in different animals; also that in human beings those in bad health (especially with heart disease and nephritis), are more affected than those in good health. He has also shown that during anæsthesia and during sleep, the body is much less susceptible than it is when the person or animal is conscious. States of anxiety increase the danger.

The following cases are illustrative :—

Fatal industrial accident :—[1]

"T. P. L., aged twenty-three, was engaged in making connection with a house, and while working in the surface box he was observed to fall to one side as if in a fit. A fellow-workman ran to him and found him with his left arm contracted, and attached by his left hand to the connecting wire (the wire was immediately broken by a blow with an axle handle), and when released he gave a loud sigh and fell forwards on to his forehead, but made no further movement or sound. I saw him about five minutes after the occurrence. The heart and respiration had then stopped. The face, neck, and upper extremities were congested, the eyes suffused, and the pupils widely dilated. The features were not distorted, and the face wore a peaceful expression. There was a strong smell of burning not unlike the smell of gas, and it was at first reported that the man had fallen down while working on a gas main. The palm and first two fingers of the left hand were burnt and charred, and the fingers were strongly flexed. The clothing was not burnt or injured in any way. Artificial respiration was at once commenced, and was maintained for more than an hour, but the patient did not respond in any way, and it was evident that the case was hopeless. Besides artificial respiration, an injection of strychnia was given, with the idea of stimulating the respiratory centre, and the faradic current was applied to the precordia. At the inquest the current which the man received was said to have been a rapidly alternating one (10,000 alternations per second), of a strength of about 2,000 volts. It was not clearly shown how he had completed the circuit, for at the time of the accident he was holding only one wire with the left hand, which was burnt, but there was no other burn on any part of the body. The piece of wire which he held had in some way become denuded of the insulating rubber. A *post-mortem* examination was made three days and sixteen hours after death. The body was that of a well-developed, muscular young man. The congestion of the face, neck, and upper-extremities, and ocular conjunctiva remarked at the time of death was still noticeable. *Rigor mortis*, which had set in shortly after death and had been strongly marked, was still present to a slight extent in the lower extremities. Decomposition was not advanced in any unusual degree. The whole of the palmar surface of the forefinger and middle finger of the left hand was burnt, and the tissues of the carpal half of these two fingers were destroyed and carbonised, exposing the flexor tendons. The epidermis generally of the palm of the hand, the palmar surface of the thumb and of the cleft between the thumb and index finger, was burnt black, and separated from the deeper structures of the skin. On the dorsal surface of the hand, between the thumb and index finger, the epidermis was destroyed and missing over a surface the size of a florin. There was a small circular abrasion, not a burn, on the outer side of the right knee, and a small ecchymosis and swelling over the right frontal eminence. There were no other external marks of injury. The vessels of the scalp, meninges of the brain and brain surface, were congested and full of liquid blood, and the surface of the white substances when cut across presented a punctate appearance. The brain and cerebellum appeared quite healthy. The mucous surface of the larynx, trachea, and bronchi was much congested, and the lungs loaded with dark blood. The heart was normal in size and consistence, and its valves healthy. Although not contracted, its cavities were completely empty, and there was a deficiency of blood in the large vessels. The liver was much congested and of a dark red colour. The spleen was large and engorged with blood

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[1] *Lancet*, December 3rd, 1892.

The kidneys were large (especially the left), and congested ; the stomach and intestines were normal in appearance ; the bladder contained about eight ounces of highly albuminous urine. A marked feature of the examination was the complete fluidity and dark colour of the blood, not a clot being discovered in any part of the body."

Fatal case of lightning stroke [1] :—

"On April 28th, 1897, I was called out to see G. C., farmer, aged fifty-four, who had apparently been struck dead by lightning about half an hour before. On arrival I found the man dead, and lying on the kitchen floor, where he had been placed when brought in. He was found about thirty yards from the house lying dead at full length, with his face downwards, his right hand in his trousers pocket ; a small pool of blood was under his head. Both cloth leggings were torn almost from top to bottom, and a small piece of one was lying near. On proceeding to examine the body, I found over the situation of the upper anterior angle of the left parietal bone a wound the size of a penny, the soft structures of which were quite disorganised down to the bone, but the bone appeared uninjured. The hair round the wound was burnt, and a good deal of blood was coagulated in the hair around. From the direction of this wound a red line of hyperæmia about a quarter of an inch broad could be distinctly seen running in an oblique direction down the neck and over the middle of the clavicle to the epigastrium. The hair of the neck and body was burnt and singed along this line, and there was a strong smell of burning when the clothes were removed. At the epigastrium this line merged into a diffused hyperæmia, which involved the whole of the lower half of the trunk and both the thighs. The hyperæmia ended at the knees, but a red line similar to that above described ran down the outer side of the right leg and foot to the little toe. The inner surface of the right boot was torn along a line corresponding to this. On the under-surface of the left foot, just below the instep, was a fresh bleeding wound the size and shape of a threepenny piece. There were two bullæ about the size of a man's thumb in the left groin. On removing the body upstairs, the wound on the head began bleeding again, so freely that a considerable pool of blood (about half a pint) was formed on the floor ; this would appear to indicate an abnormally fluid state of the blood. The face was very livid. There was no watch or any other article whatever found in the pockets. There was an iron wire round the brim of the hat, apparently used for stiffening purposes ; the hat itself was torn to pieces, leaving this exposed. It was found about a yard away from the body."

Non-fatal case of lightning stroke [2] :—

"In the early part of November, 1901, a non-commissioned officer was sleeping with three other men in a tent, when suddenly an electric discharge killed his companions. The man experienced what he described to me as a 'throbbing burning' pain in his right elbow and 'pin and needle' sensations extending 'down the thigh and leg of the same side and lasting a few minutes.' He then for half an hour lost the use of his arm and leg, but consciousness never left him. The patient's wounds were dressed, and he was taken to Middleburg Hospital. On examination on November 23rd, I discovered an extensive granulating ulcer on the outer surface of the right elbow and on the outer surface of the right thigh concentric pouched-out-looking scars, five on the outer surface of the leg, one over the external malleolus, and one over the ball of the little toe. They varied in size from a half-crown to a threepenny-bit. The scars corresponded to circular 'pin-head' perforations in his riding breeches and socks. There was a mere trace of charring at the periphery of the punctures. There was neither anæsthesia nor atrophy of the muscles. The knee-jerk reflex was absent on the affected side, but the other reflexes were normal. There was no reaction of degeneration. Pressure over the brachial plexus and over the great nerves in the upper part of the arm elicited a feeling of 'electric shocks' and visible tremors of the whole limb. There was no result on applying similar tests to his leg. Four times a day for the previous fortnight at regular intervals the patient had an attack of 'tremors' in his right arm and leg, which lasted for fully five minutes. He complained of no pain during these attacks, but said that he had a feeling of loss of power. The attacks suddenly ceased. The patient had no trouble throughout with his bladder or rectum. He was under my charge for about sixteen days, during which time no special treatment was given beyond the ordinary rules of dietary and rest in bed for a few days. He made a complete recovery, and was sent to England on a hospital ship."

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[1] *B.M.J.*, October 23rd, 1897

[2] *Lancet*, November 8th, 1902

Two fatal cases of lightning stroke [1] :—

"Two brothers were driving together in a dogcart during a thunderstorm. They were apparently struck by lightning, and seem to have fallen simultaneously out of the back of the vehicle, for they were found about five minutes after the flash lying side by side on the road, with the seat of the dogcart under their legs and the driving apron over them. I found them both quite dead ; the bodies were lying in the road in the same position as they were found. The elder brother had no external sign of injury. The younger brother presented the following appearances :—The epidermis was burnt over the chest and abdomen from the neck to the pubes, not continuously, but in a number of circular holes from one-sixteenth of an inch to a quarter of an inch in diameter. The metallic collar stud was fused, and the skin beneath was deeply burnt. An odour of burnt flesh pervaded the whole width of the road. The back from the neck to the buttocks was burnt, but less severely than in front. The vest and shirt were charred, but the waistcoat and coat were uninjured. The woollen drawers and trousers had a hole burnt in them about two inches in diameter corresponding to a burn on the right buttock. On the occiput there was a contused scalp wound, evidently due to the fall from the vehicle. There were no other injuries, nor were any of the clothes torn off either of the bodies. Neither urine nor fæces had been voided. There was still no *rigor mortis* an hour and a half after death. His watch was going, and seems not to have been magnetised, as it has kept good time since. The cloth of the cushion on which the younger brother sat was burnt on its outer surface, but the wooden seat beneath was uninjured. The tailboard of the dogcart had the paint slightly singed immediately behind the younger brother's seat, otherwise the vehicle bore no traces of the lightning. The horse was uninjured, and trotted home of its own accord. The road also bore no traces of the lightning."

In 1864, Mackintosh was called to see three persons who had been struck by lightning about *twenty minutes* previously. They had taken shelter under a haystack, which had been set on fire by the same flash.

(1) A boy, *æt.* 10, was then able to walk, although unable to move his legs immediately after the occurrence. All that he remembered was, he saw the stack on fire, and called to his father ; he felt dizzy all over, and unable to move. His hair and clothes were not singed, and the metallic buttons on his dress showed no signs of fusion. On removing his clothes, a slight odour of singeing was perceptible. He complained of pain at the lower part of the abdomen. There were several red streaks, of about a finger's breadth, running obliquely downwards and inwards on either side of the chest to the middle line in front of the abdomen ; they then descended over the pubes, and were lost in the perineum. It does not appear that there was any abrasion of the skin. This boy recovered ; the red streaks gradually disappeared, and could hardly be traced four days after the injury. (2) Another boy, *æt.* 11, lay prostrate and unconscious, with an expression of terror and suffering ; he frothed at the mouth, moaned piteusly, and flung his legs and arms about in all directions. The respiration was deep, slow, and laborious the heart palpitating, the pulse weak and very irregular ; the pupils were dilated and insensible to light. There were in this case several red streaks converging from the neck and shoulders to the middle of the chest-bone, and passing over the abdomen until they were lost on the pubes. There were similar streaks radiating for a few inches from the tuberosity of the ischium on each hip in different directions until they were lost in the skin. It appears that this boy was in a sitting posture when struck. The hair on the back of his head and neck was singed, and the peculiar odour of singeing was perceived, although his clothes showed no traces of burning nor the metallic buttons of fusion. The boy became conscious in five hours, and rapidly recovered. The red streaks gradually disappeared, leaving streaks of a

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[1] *Lancet*, June 3rd, 1899.

scaly glistening white appearance, which ultimately left no trace of their existence. (3) A man, *æt*. 46, was, like the two others, in a sitting posture, and he appeared to have been killed on the spot; he had not moved. The countenance was placid, and the pupils were widely dilated. The electricity had produced a large *lacerated wound* of the scalp, at the junction of the occipital with the parietal bones, but without causing any fracture. It appeared to have passed down each side of the head, between the soft parts and the cranium. On the left side it had passed downwards in front to the left ear, and terminated at the side of the neck, rupturing blood vessels and muscles and causing swelling of the parts, with effusion of blood. It presented the appearance of an extensive bruise caused by mechanical violence On the right side the current had passed down to the space above the collar-bone causing lividity and swelling of the right ear as well as of the adjacent skin; and it terminated in a dark blue mangled patch of skin, in which there were several free communications with the surface. The hair on the back of the head was slightly singed, and that in front of the chest was singed quite close to the skin, but the hair which covered the wound in the scalp, where the current had entered, was uninjured. The clothes, which were at the time very wet, were neither torn nor burnt, and the metallic buttons were not fused. The left side-pocket of the trousers contained several lucifer matches and a tin tobacco-box, which were unaffected. The right pocket contained a knife, which was strongly magnetic. The body was placed in a warm room, and cadaveric rigidity came on in fourteen hour after death.[1]

These cases present the effect of lightning in three degrees: the effect of a slight shock in No. 1, of a severe shock in No. 2, and of a fatal shock in No. 3. There was but little bodily injury in any of them, and no appearance of burning. The wound to the scalp and the injuries to the neck in No. 3 might have been ascribed to the violence of another had not the circumstances been fully known. The clothes probably escaped burning or tearing by reason of their being wet, and thus readily conducting the electric current.

The following exemplifies the severe burns occasionally seen. It also shows that the dress may be burnt without the surface of the body being simultaneously injured; and, further, that a burn may be produced on the body, although the clothes covering the part may have escaped combustion.

"A man, *æt*. 23, while engaged in milking a cow in a wooden shed during a severe thunderstorm, suddenly observed a vivid flash of lightning, which killed the cow instantly, and inflicted severe injuries upon himself. Fisher saw him sixteen hours after the accident, and found a severe burn on his person, extending from the right hip to the shoulder, and covering a large portion of the front and side of the body. His mind was then wandering, and there were symptoms of fever. The man was confined to his bed for seventeen days, and at the end of that time the injuries had not perfectly healed. On examining his dress, the right sleeve of his shirt was found burnt to shreds, but there was no material burning of any other part."

The following cases illustrate the severe internal injuries occasionally seen:—

A man was working in the field, endeavouring to kindle a light with a flint and steel, when the lightning struck him. For a moment after the shock he stood still, and then fell heavily to the ground, dead. The electricity had entered at the upper part of his forehead, perforating and tearing his hat at that part; it seemed then to have been divided into two currents, which passed down the sides of the body, along the lower limbs, and out at the feet. On the upper part of the forehead was found a soft swelling, of a dark blue colour, and about the size of the palm of a hand; the hair which covered it was uninjured. From this spot two dark red streaks proceeded in different directions. One of these passed to the left, running over the temple, in front of the left ear, down to the neck to the surface of the chest, over which it passed between the left nipple and the armpit, and so made its way over the body to the left inguinal region, where it formed a large irregular, scorched-looking patch on the skin. From this point the dark red streak again continued its downward course, passing over the great trochanter, then along the outer surface of the left leg to the back of the foot, where it terminated in several small dark blue spots. The other streak, which proceeded from the ecchymosed swelling on the forehead, passed directly to the right ear, which was considerably swollen and of a dark blue colour; from the ear it ran, downwards and backwards along the neck, crossed the right border of the scapula and eventually reached the right groin, where a scorched patch of skin, similar to that in the left groin, was found. From this part the discoloured streak, continued down the outer side of the right leg to its termination on the back of the foot, just as on the left side. Although the hair on the forehead, as well as that which occurred in any part of the track taken by the electric current down to the groin, was not burnt, yet at the groin itself, and at every part between this and the foot over which the electric stream had passed, the hairs were completely burnt. The cause of the skin and hair in the groin being burnt is probably to be referred to the buckles of a belt which the man wore round his abdomen at the time of the accident; the belt was completely destroyed. The swelling of the head was found to be due to the presence of a large quantity of extravasated blood. The bone beneath was not injured. Blood was effused in other parts of the scalp corresponding to the swollen discoloured patches outside; about four ounces had been effused. A large quantity of reddish mucus was found in the larynx, windpipe, and air-tubes. The lungs were loaded with dark blood; there was a great deficiency of blood in the cavities of the heart and in the large vessels. The blood vessels of the stomach and intestines were more than usually congested. The right lobe of the liver was of a dark red colour, and loaded with blood, especially the part which corresponded to the burnt patch of skin at the lower part of the abdomen. The spleen also was large, and filled with blood. Much blood was found accumulated in the substance of the muscles of the abdomen, at those parts which lay beneath the burnt surfaces outside.[1]

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[1] *Lancet*, 1864, 2, p. 118.

In the case of an old man killed by lightning, the external surface of the body presented only slight marks of violence, except the left ear, which was severely lacerated. The left hemisphere of the brain was entirely disorganised, forming a homogeneous, almost liquid mass, of a greyish colour, and without a vestige of normal structure, except a small portion of the corpus striatum, which had retained its natural appearance and situation. The left lung was partly injured. The skin of the abdomen was marked by black longitudinal superficial lines. On the skin of the left ankle there was an acchymosed spot, and in the foot a deep wound. The hat and shoes of the deceased had been destroyed, but the rest of his clothes were uninjured.

A man was struck during a storm and suddenly thrown on his face. He was seen soon afterwards, and was then moaning and quite unconscious; the legs were parlysed, and the arms partially so. His hat, jacket, waistcoat, trousers, and one boot were rent and ripped open. Blood was flowing from a serrated wound over the right temple, from several small wounds over the head and face, and also from the mouth, which was lacerated. There was no ecchymosis or contusion near any of the wounds. The bladder was paralysed. No fracture could be discovered. In twenty-seven hours the symptoms had become aggravated; he was very violent, and much ecchymosis appeared around the right eye. The hair on the right side of the head, eyebrows, eyelashes, and whiskers, in some parts, was quite burnt off, and in others scorched, as was also the hair on the trunk, over the pubes, and down the right leg, the cuticle in many cases being completely charred. Some blood oozed from the mouth and nose; the palate was charred and black, the mouth drawn a little to the left side, the tongue dry and brown. He passed another restless night; twitchings of the muscles came on, with facial paralysis; and he died without recovering consciousness, fifty-seven hours after he had been struck. On inspection much blood was found effused between the scalp and skull. A fine fracture, one inch and a quarter long, was found in the squamous portion of the temporal bone, terminating at the suture. There was another fracture at right angles to this, the included portion of bone being black and charred. The temporal bone was forced out, and raised above the level of the other bones. On the dura mater, corresponding to this fracture, there was an effusion of thick blood. The membranes of the brain were torn, and the substance of the brain lacerated. A charred spot was seen on the orbital plate of the frontal bone, through which the electric current had passed.[1]

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[1] *Oesterreich. Med. Wochenschr.*, June 6th, 1846.

In the *Lancet* (1909, 1, p. 34) will be found a case of death from lightning in which the humerus and spine were both fractured. *Vide* also p. 47 of the same volume for an interesting summary of cases.

In the two following cases the inquests are reported in full, for they have many interests other than purely medical: accident insurance, precautions against accidents, etc.

On March 15th, 1904, an inquiry was held in regard to the death of a boy, named Edgar Furlonger. It appeared the lad was cleaning a terminal, which he ought not to have touched without orders. When cleaning was necessary the current which had a power of 10,000 volts, was cut off, and there was no current where deceased was standing, but evidently he tripped, and put his hand on a "live" part. An electrical linesman named Baker saw the current flash out from the terminal in the corner of the room where the boy was, and caught him just as he was about to fall. He was unconscious. Baker at once sent for a doctor, and meanwhile started artificial respiration, with the result that the deceased regained consciousness. On recovering he said, "Hello! what have I done? What is it?" and then lapsed into a semi-conscious state again.

Dr. Kenneth Black, house surgeon at Guy's Hospital, stated that the lad was severly burned about the limbs. Part of the right arm was dead. He very soon got over the shock of the accident. Witness called in two surgeons, and it was decided to remove three limbs. On the Monday following, deceased's right arm was removed, and on the Thursday both legs were amputated. The boy died from heart failure, following on the injuries he had received from the electric shock and the superadded strain of the extensive surgical measures which were necessary. The artificial respiration resorted to by Mr. Baker had undoubtedly prolonged deceased's life.

We insert the following case on account of the interesting explanation offered by the expert:—[2]

A strong man, aged 21 years, worked at a forge in a machine shop. Over the forge hung a sixteen-candle-power incandescent electric lamp. He reached for the lamp apparently to turn on the light and cried out. His fellow-workmen rushed to him and found him rigid, leaning against an adjacent wooden partition, and tightly clutching the lamp with his right hand. On breaking the contact with the lamp he fell to the floor. Efforts to resuscitate him by artificial respiration failed. All the middle joints on the back of the right hand were burned, and the bone was laid bare. The lamp was hung on cords from the rafters, where its wires tapped the main wires of the building, which carried 110 volts of electricity. Careful examination failed to reveal anything out of order in the electric supply of the building: the fuses were in place at the entrance of the wires and in each lamp. In the vicinity of the building were wires carrying a much higher voltage (2,300 volts) from the generating station to transformers, which reduced the voltage in the secondary currents supplied to the houses to 110. The wires from the building led to a transformer several hundred yards distant. A current of 110 volts is ordinarily used for electric lights and is relatively safe to handle; it may pass through the body without causing anything alarming. The fatal shock must have resulted in some way from the primary current of 2,300 volts escaping to the wires of the lamp. An electrical expert explained the accident as follows. By various means, for example, by the limbs of trees rubbing against the wire of the primary current, an opportunity may be given for escape to earth. This, however, may not occur unless a second mode of escape is possible. Then a short circuit is formed through earth from one point of escape to the other, as it offers the least resistance to the current. In this case probably one leak occurred somewhere in the primary circuit as a result of a tree rubbing against the wire. The current was then, so to speak, waiting for another leak to earth. The coils in the transformer, in consequence of poor insulation or other cause, may have allowed the primary current to escape on to the secondary wire. When the man seized the lamp, he formed the second connection with earth, and the primary current of 2,300 volts passed through him. In the *Lancet* of January 26th, 1907, p. 246, we referred to a similar accident which also occurred in America. A man received a fatal shock while using the telephone and holding an electric lamp. This was attributed to the main electric and telephone wires having been swayed together by the wind where they crossed, the insulation being burnt off, and a current of 3,500 volts passing into the telephone wire. In the system of electric lighting now installed in Boston, a device is adopted to prevent such accidents. The secondary wire is connected with earth at the transformer. If any of the primary current escapes to the secondary wire, it therefore at once goes to earth.

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[1] *Lancet*, 1872, 2, p. 77.

[2] *Lancet*, 1901; I, 1266.

A case of some interest occurred in Dunedin, New Zealand, in which a young man accidentally slipped and fell on an electric lamp he was holding at the time, and died at once. The guard of the lamp caused a burn in the neck which passed to the windpipe, and its lower end lay on the right vagus nerve. There was no other trace of injury, and the organs were perfectly healthy. The floor was wet, and there was a leakage from the lamp of 50 to 70 volts. Death was attributed to heart failure from vagus inhibition.

Wireless Aerials and Lightning Injuries. A case is recorded[1] in which a young woman was struck by lightning through an earthed wireless aerial. The report is as follows :—

" On the night of July 27th, I was called to see a young woman who was said to have been struck by lightning. Over the right hips she had a large bruise about six inches in diameter, with a central area of scorching. She was also suffering from a mild degree of shock. *Her clothes were quite uninjured.* At the time of the accident she had been standing close to the lead in ' of the wireless aerial. This had completely fused, and it seemed to be the flash from the fusing wire which had done the damage. She described it as seeming as though the whole of her right side had caught fire.

" Considerable damage had been done to the window frame at the point where the wire entered the house, and bricks had been dislodged from the wall, this although the aerial was ' earthed ' by a switch inside the house. Apparently this common form of protection against lightning risks is useless.

" The aerial, which was of seven-strand copper wire, was fused in several places."

The Marconiphone Company replied to this as follows :—

" Our opinion is that a wireless aerial properly erected and well earthed with a good earthing switch, which is kept clean, or by means of plug-in contacts which are kept clean, is a distinct safeguard during a thunderstorm, as the aerial will cause the potential strain between the thundercloud and the aerial to be lowered, due to discharge from the aerial, so that a lightning flash will not take place between the cloud and the points immediately in the vicinity. This is the principle of the lightning conductor.

" However, it is possible, due to sudden changes in cloud formation during a thunderstorm, for the potential to rise so rapidly that even this protection will not lower the potential quickly enough to prevent a flash taking place, and then, of course, a certain amount of damage may be done.

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[1] *B.M.J.*, August 15th, 1925

"In the particular case quoted by your correspondent, had the earthed aerial not been there, there would seem every possibility of some other point on the house being struck, with results which would probably have done very considerably more damage, and the person who was unfortunately slightly hurt might have been killed."

LEGAL RELATIONS OF LIGHTNING AND ELECTRICITY

Whereas cases of suicide and homicide are rare, electric current has been employed for *suicidal* purposes on several occasions. Many years ago a Frenchman with this intent, deliberately took hold of the conductors of a dynamo-machine at the works of M. Chertemps in Paris, and was instantaneously killed. In recent years, several cases have occurred in which suicide has been suspected, and more than one in which death has occurred as the result of a prank or malicious practical joke. Breitenecker, L (Internat. Kong ger Med., Bonn, 1938), quotes a case of suicide in which a man killed himself by throwing a wire over an overhead electric cable. His hand was completely severed and thrown some distance from the body.

In 1925, a boy in Glasgow was killed as a result of a practical joke. The handle of a hut which he had to enter was connected with an electric light switch. When he touched the handle he uttered a cry and fell to the ground in an unconscious condition. Death occurred fifteen minutes later.

From the *post-mortem* appearances it would be impossible to ascertain by medical evidence whether a person had been wilfully killed by electricity; it must be decided entirely by circumstantial evidence. One could imagine a murderer possibly persuading his victim to touch dangerous live wires or placing him in such a position that he was exposed to a fatal shock.

The following is an account of the first execution by electricity:—

"In August, 1890, a murderer, Kemmler, was judicially executed by electricity at Auburn, U.S.A., the current being introduced into the body at the shaven scalp. At the necropsy there was a well-defined circle at the top of the head where the skin had been scorched, and a circular spot four inches in circumference on the small of the back where the second electrode had been applied. The body was much burned, and became rigid within an hour of death. On the brain and beneath the spot where the electrodes had been applied, the blood was burnt to a carbonaceous mass. The spinal cord, brain, muscles, heart, and abdominal organs were normal.[1]

Actions for Damages. The possibilities are endless in the way of delayed effects and traumatic neuroses for which compensation may be claimed. When such a case is brought before the courts the chief question which has to be settled by neurological experts is—Is the alleged loss of function due to organic change or to functional impressions; is it due to hysteria, neurasthenia, or nerve degeneration?

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[1] *B.M.J.*, 1890, 2, p. 354.

CHAPTER XIII

DEATHS CONNECTED WITH COLD AND HEAT, SPONTANEOUS COMBUSTION, VITRIOL THROWING

EFFECTS OF COLD

The effects of cold upon the human body may be local or general, and the severity of such effects depends mainly on the intensity of the cold and the duration of exposure. Local and general effects are, of course, frequently found existing in the same individual.

A. Local Effects

The localised effects of cold fall almost exclusively within the sphere of clinical surgery, and comprise the conditions known as frostbite, trench foot and immersion foot. This nomenclature reflects the different environmental factors involved in the etiology of the conditions, but exposure to cold is the fundamental factor in all three. Trench foot and immersion foot are almost certainly one and the same thing, namely, that condition which affects the extremities as a result of prolonged exposure to severe cold and dampness, such as is typically experienced by soldiers during winter warfare, especially in trenches, and by shipwrecked sailors. Cold is the determining factor, of which the dampness can be regarded simply as the agent. Frostbite is the corresponding condition due to exposure to greater extremes of cold, with which a relatively dry environment is more common. Frostbite can develop more rapidly than trench foot, and, in addition to the extremities, it more frequently affects other parts, *e.g.*, nose, ears, and even the relatively flat surfaces of the face.

The underlying pathogenesis is not fully understood, but is no doubt similar in all three conditions. In connection with their work on immersion foot, the term "peripheral vaso-neuropathy after chilling" has been suggested by Blackwood and Ungley,[1] and the term would seem applicable to the other conditions also. The effects of cold on the vascular tissues and the vascular innervation of the extremity result in an ischæmia sufficiently severe to cause tissue damage. This damage is, perhaps, aggravated by the inability of the available hæmoglobin to liberate oxygen because of the depressed temperature in the affected part. Swelling and œdema result from loss of fluid through damaged vascular endothelium, while corpuscular stasis and agglutination occur within the capillaries. True thrombosis may follow later as a secondary phenomenon. As a result of such changes, the local capillary circulation may remain impaired even after removal to a warmer environment, and the persistent anoxia is rendered still more damaging by reason of the increased metabolic requirements of the tissues at a higher temperature For a full consideration of the pathogenesis of frostbite, trench foot and immersion foot, the papers of Greene, Blackwood and Ungley, and others should be consulted.

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[1] *Lancet*, October, 1942.

From a clinical point of view, the results range from transient, reversible changes, through a variety of irreversible changes which recover only by slow regenerative processes, to complete tissue loss by gangrene. From a medico-legal point of view, the only significant observation to be made is that many of these changes can only occur in tissues which are *living* at the time of exposure. Hence, if severe local effects of cold are discovered on a dead body, it is conclusive medical proof that the person was living when they were produced.

Treatment is a matter for the surgeon, but, in the stage of first aid, the important thing is to remember that sudden warmth may aggravate the damage. The body should be well wrapped and warmed, but the affected parts kept cool and dry. Wet cold and friction are harmful, and the traditional procedure of rubbing with snow is therefore not to be advocated. Elevation of the affected limbs may be beneficial.

The period of disability depends, of course, on the clinical severity of the case, and varies therefore from a few days or weeks to many months. The possible sequelæ, which may in some cases constitute a considerable disability, include persistent circulatory deficiency, with cold sensitiveness and cramps, recurring pain, tingling and swelling, hyperidrosis, and late blisters, or even ulcers and gangrene.

B. General Effects

The general effects of cold are more frequently of medico-legal significance.

The protracted exposure of the human body to a low temperature may cause death ; and although in Britain cases but rarely occur in which cold alone operates fatally, it is not unusual during a severe winter to hear of persons, in a state of ill-nourishment and destitution, being found dead in exposed situations. Accidents in mountain-climbing are sometimes recorded in which death is due to simple exposure. On these occasions one may frequently suspect that the lack of proper food and nourishment has accelerated death. It is, however, convenient to make a distinction between the effects on the system of cold on the one hand, and starvation on the other, as the symptoms preceding death and the rapidity with which it takes place are different in the two cases. According to the Registrar-General's report for England and Wales in 1940, there were 36 deaths at all ages due to exposure to cold, including 25 males and 11 females. From time to time there occurs an occasional case of murder or manslaughter from the same cause.

Symptoms of Exposure to Cold. A moderate degree of cold is well known to have an invigorating effect upon the body ; but if the cold be severe, and the exposure to it long continued, while the animal heat is not maintained by warmth of clothing, exercise, or food. the skin becomes pale, and the muscles become gradually stiff and contract with difficulty, especially those of the face and extremities. Sensibility is lost, and a state of torpor ensues, followed by profound sleep, from which the person cannot readily be roused; in this state of lethargy the vital functions gradually cease, and the person finally perishes. Such are the general effects of intense cold upon the body. Its influence on the nervous system is seen in the numbness, torpor, and sleepiness which have been described as consequences of a long exposure to severe cold. Giddiness, dimness of sight, and paralysis have in some cases preceded the fatal insensibility. It was observed during the retreat of the French from Moscow that those who were most severely affected by cold, often reeled about as if in a state of intoxication; they also complained of giddiness and indistinctness of vision, and sank, under a feeling of lassitude, into a state of lethargic stupor, from which it was found impossible to rouse them. Sometimes the nervous system was at once affected; tetanic convulsions, followed by rigidity of the whole of the voluntary muscles seized the individual, and he rapidly fell a victim. Symptoms indicative of a disturbance of the functions of the brain and nervous systems have also been experienced by Polar travellers during their residence within the Polar circle.

Treatment. Rescued victims of exposure require warmth, and there is no reason why the warming process should not be rapid, and accompanied by the judicious administration of stimulants. Atropine may be of particular value, also intravenous glucose, because of the hypoglycæmia which is stated to be present.[1]

Cause of Death. At low temperatures, tissue metabolism is diminished, and when cooling of the body becomes general, owing to prolonged exposure to severe cold, the cells of the central nervous system must share in this lowering of activity. Moreover, at low temperatures, the capacity of hæmoglobin both to take up oxygen and to release it is modified. Less oxygen is taken up from the atmosphere, but once taken up, it is less readily dissociated. In the body, both factors contribute towards a tissue anoxia which depresses cellular vitality still further. The results of this on the central nervous system are reflected in the progressive lassitude, defective cerebration and other nervous symptoms, and as the vital centres become more severely affected, there is slowing of the heart and respiration rate. Death results from the ultimate failure of the vital centres, and is, perhaps, accelerated by the direct effect of cold on the heart itself.

Circumstances Accelerating Death in Exposure to Cold. The degree of cold and the duration of the exposure are obviously the main factors which determine the effects produced, but it would appear also that cold has a more depressing influence under wet or damp conditions than when the air is dry. Moreover, there are marked individual variations in susceptibility to cold. The very old and the very young suffer severely; infants, especially when newly-born, perish quickly from exposure to cold. Among the intervening age groups which comprise the majority of mankind, most writers on the subject agree that the greater susceptibility is found in individuals of the fat-deficient, asthenic, vago-tonic type. The explanation may lie partly in the absence of fat, but even more in the neuro-vascular endowment of such individuals. In this connection, an observation of Koch has been quoted, namely that "cardiac vago-tonics are potentially circulatory sympathetico-tonics." Conversely, the short, stocky, "pyknic" type of individual is generally more resistive.

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[1] Gross-Brockhoff & Schoedel. Arch. f. Exper. Path. u. Pharm. 1943 v. 201 No. 5.

The contributory effects of wounds and blood loss, or other conditions associated with shock, can be readily understood. The grave combined effects of exposure to cold and wound shock are very familiar to all who have been responsible for the early treatment of battle casualties.

In all cases in which there is exhaustion of the nervous system, as in those who are worn out by disease or fatigue, in the aged and infirm, or, again, in persons who are addicted to the use of intoxicating liquors, the fatal effects of cold are more rapidly manifested than in others who are healthy and temperate. It has been generally remarked that whenever the nervous energy is impaired, either by intoxication or exhaustion from fatigue, a man dies quickly from cold. The exposure of drunken persons during a severe winter night may therefore suffice to cause death, although the cold may not have been so intense as to affect others who were temperate. Casualties of this nature sometimes occur during the winter season; and a knowledge of the influence of intoxication in accelerating death in such circumstances may occasionally serve to remove a doubt in the mind of a medical man respecting the real cause. Alcohol is well known to cause a flushing of the skin, and hence a greater loss of heat. Many experiments have been made showing the bad effects of alcohol on the powers of withstanding exposure.

Post-mortem Appearances. The skin is commonly pallid, with patches of redness on the cheeks, and lips and other exposed parts. They are not found on covered areas. The viscera of the chest and abdomen as well as the brain are congested with blood. The blood is often of a bright red colour, suggestive of carbon monoxide poisoning due to the retention of oxygen by hæmoglobin at low temperatures.

The appearances of death from cold, cannot be regarded as characteristic, and there is always great difficulty in deciding whether death has taken place from that cause. The season of the year, the place and circumstances in which the body is found, together with the absence of other possible causes of death (such as from injuries or internal disease), form the only basis for a medical opinion. Death from cold is not to be determined except by negative or presumptive evidence; for there is no organic change, either externally or internally, sufficiently characteristic of it to enable a medical man to give a positive opinion on the subject.

With reference to the florid condition of the blood, it must be remarked that this is observed only while the body remains at a low temperature; it depends on the retention by the hæmoglobin of its oxygen at this low temperature. This bright red hue of the blood in the heart, if carbon monoxide and nitrites are excluded, strongly suggests death from cold. It is not produced by exposing dead bodies to the influence of a low temperature, because the atmospheric oxygen cannot diffuse itself so far internally as the heart. The colour of the blood depends on the amount of oxygen actually in combination with the hæmoglobin; exposure to cold *after* the combination cannot dissociate the gas and the hæmoglobin, and therefore cannot alter the colour of blood once that colour is assumed; it can only prevent the assumption of a certain colour by checking chemical processes.

If putrefactive changes have commenced before the body is exposed to a low temperature, the characteristic colour does not appear, because tissues undergoing decomposition are active deoxidisers.

For the progress of putrefaction in such bodies *vide* " Decomposition," where the influence of cold on putrefaction is fully dealt with.

Medico-legal Relations of Death from Cold

There is but little on this subject noteworthy in the annals of crime, although the following cases show that such do occasionally occur :—

Case of murder by cold. A man and his wife were tried for the murder of their daughter a girl *æt.* 11, in the following circumstances : On December 28th, at a time when the weather was severe, the woman compelled the child to get out of her bed and place herself in a vessel of ice-cold water. The child cried and endeavoured to escape from the bath, but she was by violence compelled to remain in the water. The child soon complained of exhaustion and dimness of sight ; the female prisoner then threw a pail of iced water upon her head, soon after which the child expired. Death was attributed to the effects of this maltreatment, and the woman was convicted.

Exposure to degrees of cold not in themselves very severe may so lower the resisting power of the individual that death results.

A man and a woman were sentenced to fifteen years' and five years' penal servitude respectively for ill-treating a child of eleven by starvation and exposure in winter in a bedroom where there was no fire. The fact that the child was insured for £25 supplied the motive, and probably accounted for the sentences.

Foundlings frequently die from exposure in this way, even when, as in the following case, some care seems to have been taken.

An inquest was held on the body of a child a few weeks old which was found lying on a doorstep in cold weather ; it was well clothed (white shirt, roller bandage, long nightdress, two shawls, pink wool shoes and flannel hat). Verdict : death from exposure.

It is probable that thousands of lives are lost at sea and elsewhere every year, through a combination of cold with exhaustion, rather than from actual drowning, although they are commonly said to be drowned. The effect of water in abstracting heat from the body has proved to be a great obstacle in swimming the English Channel. Breathing air many degrees below freezing point has no ill effect when breathing takes place through the nose, but when exertion compels mouth breathing, the lungs may become affected.

EFFECTS OF HEAT

Injuries from heat, as from cold, present themselves in two forms—local burns and general exposure to hot air. We shall discuss the points in the following order :—

A. Local Burns and Scalds—Varieties.
  Symptoms, Pathology and Cause of Death.
  What caused the Burns ?
  Was Death due to Burns ?
  Was the burning the result of Accident, Suicide, or Homicide ?
  Time required to burn a Body.
B. General Exposure to Heat.

A. Local Burns and Scalds

Varieties of Burns. A *burn* is an injury or wound produced by the application of a flame or heated substance to the surface of the body; a *scald* results from the application of a liquid at or near its boiling point in the same circumstances. There is no real distinction between a burn and a scald as to the effects produced on the body. The injury resulting from boiling mercury or melted lead might receive either appellation. Nevertheless, as a matter of medical evidence, it may be important to state whether the injury found on a body was caused by such a liquid as boiling water, or by a heated solid. If the former, the injury might be ascribed to accident; if the latter, to criminal design. A scald produced by boiling water is indicated by erythema, vesication and a sodden state of the skin, but there should be no destruction of substance, nor should there be any singeing of the hairs. In a burn by a heated solid, the parts may be more or less destroyed, or even charred; the cuticle may be found blackened, dry, almost of a horny consistency, and presenting a shrivelled appearance. The hairs may be singed or distorted. This distinction applies only to scalds from water. A scald from melted lead could not be distinguished from a burn produced by a solid heated to the same temperature. Some of the oils boil at 500° F., and they produce burns as severe as those caused by melted metals. Burns from flame are indicated by scorching of the skin and singeing of the hair, while burns from gunpowder are known not only by the scorching, but by the small particles of unburnt carbon which are embedded in the skin. Burns from corrosive substances are usually free from blisters, may show distinctive coloration and have distinctive chemical reactions. To sum the matter up, we may say generally that the temperature to which the body has been exposed, the extent of surface exposed, and the duration of exposure are the only points that materially affect results.

Degrees of Burns. Burns have been clinically divided into six degrees of severity, as follows :—

First Degree. The heat produces a simple inflammation of the skin. The skin is red, but the redness disappears on pressure: there is slight and superficial swelling, with severe pain, relieved by the contact of cold substances. The inflammation subsides after a few hours, and the skin resumes its natural condition; or it may continue for several days, and the cuticle then peels off.

Second Degree. Blisters are formed, some of which appear *immediately*, others within twenty-four hours, and those which are already formed become enlarged. Suppuration takes place if the cuticle is removed and the person survives sufficiently long. As the cutis, or true skin, is not destroyed by this degree of burn, there is *no mark or cicatrix left on healing to indicate its past existence.*

Third and Fourth Degree. The cutis is partially or completely destroyed. The burn appears in the form of yellow or brown patches. An inflammatory redness, accompanied by vesication or blistering, is perceived in the portion of the skin around the burnt area. The skin appears shrivelled and puckered towards the eschar, which is depressed below the surface. From the fourth to the sixth day the eschar falls off, leaving an ulcerated surface, which heals slowly, and is always indicated by a cicatrix, from the nature of which the depth of the burn and also the probable results of the cicatrix may be judged for purposes of medical evidence.

Fifth and Sixth Degree. In the fifth and sixth degrees, the whole of the layers of the skin, the subcutaneous tissues, and more or less of muscles and even bones, are converted into a general eschar. The appearances are similar to those of the fourth degree, but in a more aggravated form. The burnt part is completely charred. If the person survives, inflammation is set up in the subjacent tissues and organs.

SYMPTOMS, PATHOLOGY AND CAUSE OF DEATH IN BURNS

Intense pain is the principal symptom, and is more severe in superficial than in deep burns, owing to the greater implication of nerve endings. This pain is no doubt responsible for a degree of initial shock immediately following the injury, but this merges rapidly into the stage of secondary shock associated with loss of fluid from the circulating blood, and with the typical appearances of this condition. Pain becomes less severe, but thirst is a marked feature, and vomiting is common. Deaths from shock occur during the first two or three days, and comprise more than half of the deaths from burning. If the patient survives, the symptoms become those of an acute toxæmia, due to the absorption of histamine-like substances from the burned area. The temperature rises and remains elevated, and the patient is obviously very ill. Vomiting may persist. Muscular spasms and even convulsions occur. The mental state may be one of irritability or delirium, deepening to coma. Deaths due mainly to acute toxæmia occur characteristically on the third or fourth day after injury. Thereafter the chief danger to life is the occurrence of sepsis in the burned areas, with consequent septic absorption. The signs and symptoms are those of any septic toxæmia, and the post-mortem findings in fatal cases will be those typical of septic conditions generally.

In spite of much experimental and clinical work within recent years, the pathogensis in burning is still not fully understood. There is no general agreement on the incidence of the various post-mortem findings that occur, nor on the interpretation to be placed upon them. The same may be said of the many changes in body chemistry which have been noted, and even the mechanism of shock production in burns cannot be regarded as established beyond argument.

At post-mortem examination, the affected area of the body will be found reddened or charred, although the appearances may be modified by the treatment which has been applied. Hair may be found singed or bulbous in appearance. There may be blisters, either ruptured and collapsed, or tense with fluid of a highly albuminous nature, and often of a jelly-like consistency. Certain of these conditions will be fully considered later.

Apart from the local pathology of the burned area, there are no post-mortem findings which can be regarded as invariably associated with and pathognomonic of death by burning. Generalised visceral congestion is usually present in cases which have died within the first few days after injury, and there is frequently an excess of fluid in the serous cavities. Congestion and œdema of the brain have been reported as the most constant naked eye-finding in a series of cases studied in Glasgow in

1942-1943. Petechial hæmorrhages are frequently found in various organs, but especially in the gastric and duodenal mucosa and deep to the pleura and endocardium.

Changes in the liver have been described, even in cases dying early, changes ranging from inconspicuous fatty change, to a central lobular necrosis which has been considered a direct and specific effect of the acute toxæmia of burns. This opinion, however, has not been universally endorsed by other investigators, and the significance of the liver changes in burns is still undecided. This is true also of the changes which have been noted in the kidney, equally variable and ranging from cloudy swelling to necrosis and calcification.

In the present state of our knowledge, the position may be summarised by saying that severe burning causes severe shock which may prove fatal, and also gives rise to an acute and sometimes fatal toxæmia due to the absorption of histamine-like substances from the burned area, which may be associated with degenerative changes and dysfunction of various organs, notably the liver and kidney. If the toxæmic stage is survived, the chief danger to life is from sepsis or intercurrent disease, especially of the respiratory system.

Ulceration of the Alimentary Canal. Curling was the first to call attention to the occurrence of duodenal ulcers after burns ; and a number of cases have been recorded following death from burns. Harkins has analysed 94 such cases, and concluded that a severe third degree burn is most apt to result in duodenal ulceration.

Congestion of the stomach and duodenum is a common post-mortem finding. In a case in which a woman died on the thirteenth day after a superficial burn involving the skin of the lower part of her body, the stomach was found inflamed at its greater extremity, and the duodenum at its lower portion. The other intestines as far as the cæcum were also more or less inflamed.

In a Welsh legal case, it was shown that a man had sustained severe burns from an explosion of fire damp in a coal mine. He partially recovered from the first effects, but lingered for nearly three months, when he died, according to the medical evidence, from inflammation and ulceration of the bowels. There was no other apparent cause of this inflammation but the burns, and death was referred to the burning as the primary cause, there being no actual recovery from the time of the occurrence until death.

The Colour of the Blood. In examining the bodies of victims of fire accidents, the blood is sometimes found to be bright red in colour and shows the reactions for carboxyhæmoglobin. When this is so, it is probable that carbon monoxide poisoning was at least partly responsible for death, and may confirm that the person was alive when burning took place.

Carbon Particles in the Lungs. The mucous membrane of the nose, naso-pharynx, larynx, trachea and bronchi, must be carefully examined for carbon particles inhaled with the smoke, for their presence is strong confirmatory proof that the victim was alive when the fire occurred.

In examining the bodies of fire accident victims, it may be necessary to note carefully all matters concerned with sex and identity. The burning of the Ring Theatre at Vienna, in 1881, gave rise to many important medico-legal investigations respecting the sex and identity of charred remains, of which Hoffman and Schutze have given a description, to which the reader is referred. The presence of a large quantity of phosphate of calcium in the ashes would indicate animal remains; but the bones are never completely destroyed. They become white, and portions of them retain their form even under the action of a most intense heat.

WHAT WAS THE NATURE OF THE SUBSTANCE THAT CAUSED THE BURNS?

Among the questions which have arisen in reference to a body found dead from burns is this: whether the burns have been caused by fire, by hot or molten metals, by hot liquids, by inflammable substances such as paraffin, petrol, etc., or by gunpowder. Paraffin, petrol, etc., may be recognized by the odour, and it is often possible to extract some of the material from the clothing.

Burns from the flame of gunpowder are generally characterised by the blackening of the skin and the introduction of some of the grains into the substance of the skin. In the Morfa colliery explosion in 1870, it was of some importance to determine whether gunpowder or firedamp had caused the death of some colliers. There was considerable difficulty in the case because explosions from gas in mines generally cause a blackening of the skin from the coal dust. The large volume of flame both in gas and gunpowder explosions causes extensive and fatal burns.

It is quite obvious that little evidence is likely to be obtainable as to causation from the burn itself if caused by a flame, the only condition for the production of a burn being a sufficient temperature.

The recognition of a scald from water presents little difficulty, and the scar of such an accident is usually characteristic (*vide* "Scars," p. 101).

Burns from hot metals cannot be distinguished from those produced by a flame, unless the shape of the burn may indicate the shape of the hot metal. The distribution of burns running down the trunk and limbs in lines suggests a liquid.

MEDICO-LEGAL QUESTIONS CONCERNING BURNS

The principal subject on which medical evidence is required on these occasions is in reference to the question whether, in a dead body found burned, the burning took place during life or after death. As bodies are sometimes burned in order to conceal criminal acts of violence, a careful inspection should be made to determine whether there are indications that violence has taken place. The ability to answer these questions must depend on the degree to which the action of the fire has been carried. The remains may be so charred as to render all investigations nugatory, but a careful dissection should be made in every case.

Homicidal burning cannot be established by medical evidence so much as by that which is presumptive or circumstantial; but there are many medical questions which arise out of the circumstances in which a dead body is found burned.

WAS DEATH DUE TO BURNING, OR WAS THE BODY BURNT AFTER DEATH?

Compared with the similar question put in cases of drowning, hanging, strangulation, and suffocation, it is but very rarely indeed that medical evidence will be the most important, owing to the circumstances which surround burns, but nevertheless, we must discuss such evidence owing to its importance in these rare cases. A final conclusion will depend upon several factors, which must be taken separately, and may be enumerated as follows :—

Can a burn be distinguished from a wound caused by other means ?
Was a given burn inflicted during life or after death ?
If during life, how long did the victim survive ?
What extent of burning is necessary to kill ?
Are there certain indications that death was from burning ?
Are there any other appearances to account for death ?

Are the Lesions due to Burning ? When once the epidermis has been removed from an area of skin by any means, the affected area will dry after death into a yellowish brown patch. Hence it is quite possible to mistake a small burnt area for a simple graze unless the temperature to which the area was exposed was high enough to singe some of the surrounding hairs, when no mistake is possible.

If large areas are involved, it is impossible to mistake a burn or scald for any other wound of superficial character, and if the trouble be deeper, it is inevitable but that there should be some scorched and roasted flesh, the smell of which is unmistakable.

In general, wounds caused by cutting or blunt weapons are readily distinguished from burns, but, nevertheless, the question may often arise owing to the fact that burnt tissues are easily cracked by movement, and the skin and deeper tissues may burst as a result of the heat. These fissures may sometimes strongly resemble lacerated wounds.

A boy, two years of age, was taken to the London Hospital so severely burned on the face, neck, abdomen, and limbs, that he survived the accident only three-quarters of an hour. A suspicion of ill-treatment having been excited by the appearance of wounds about the knees, which were observed as soon as the child was admitted, and by the reported neglect and ill-usage of the child by his step-mother, an inspection was made. The body was plump and well formed. The skin in the burned parts was deprived of cuticle and converted into a dry deep yellowish or blackish mass, which was very tense, hard, and easily torn. There were gaping wounds on both knees. On the right side a fissure in the skin commenced about the middle of the thigh and proceeded for two inches and three-quarters to the inside of the patella, where it became somewhat jagged, and making a sudden turn inwards, passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh a little above the left knee, and another, which was also transverse and measured an inch and a half in length, was situated below on the inner side of the joint. These fissures in the charred skin exposed the fatty tissue beneath, which was white, and free from any effusion of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue, its exemption from the action of the fire and the irregular character and appearance of the fissures, Curling concluded that they were not the result of wounds inflicted before the occurrence of the burn ; he considered them to have been occasioned by the influence of heat, which had forcibly corrugated the skin and completely destroyed its elasticity, and the superficial layer of fatty tissue, being closely adherent to it, necessarily gave way at the same time. In several places some small vessels containing blood were observed running across the fissures; these, being more tenacious than the fatty tissue, had not yielded with it. This appearance alone was sufficient to negative the supposition of the infliction of wounds by cutting instruments. The production of the fissures might have been aided by the child's struggles immediately after the occurrence of the burn, but it did not appear that these were at all violent.

This conclusion was justified by the facts, and the case is calculated to throw an important light on the accidental origin of fissures or wounds of the skin in cases of death from burns.

Given a Burn, was it Ante- or Post-mortem? After a murder has been perpetrated, it is not uncommon for a criminal to attempt to dispose of the body by burning it. It is, therefore, very important for the medical witness to be acquainted with the differences between a burn inflicted during life and a burn on a body already dead. Usually the body is not burned until all signs of life have disappeared; in such cases there is nothing but the charring of dead flesh, so that there can be no difficulty in forming an opinion. When the burning is partial, and has probably taken place from a wilful ignition of the clothing at or about the time of death, some caution is required in expressing an opinion. The principal points naturally turn on the signs of reaction which living tissues show toward burns. These are the production of vesicles and signs of congestion or inflammation (*vide* also "Signs of Death").

Vesication. The production of *vesication—i.e., of blisters containing serum*—is commonly regarded as an essential character of a burn which has been produced during life, but it is not a necessary or invariable effect of a burn on the living body. Vesication is especially observed in scalds, or in those cases in which the skin has been burnt by flames or by the ignition of the clothes, provided the cuticle has not been destroyed. It is not so commonly observed in burns produced by intensely heated solids. In vesication the cuticle is raised from the true skin beneath, and is converted into one or more blisters containing serum, while the skin around is of a deep red colour. It is uncertain as to the time at which it appears; it may be produced in a *few minutes*, or sometimes not for several hours; hence death may take place before vesication occurs, and the non-discovery of this condition does not warrant the opinion that the burn could not have taken place during life. If the cuticle is removed from a vesicated part of the living body, the skin beneath will become intensely reddened, but if the cuticle is stripped off a dead body, the skin will become hard, dry, and of a horny yellow colour; it does not acquire the intense scarlet injection which is acquired by the living skin when vesicated and exposed.

There have been conflicting opinions whether the presence of blisters on a dead body should be received as a absolute proof of burning during life. The following may be taken as a summary of the ascertained facts:—

A young man had poisoned himself with opium. While he was lying in a state of coma, four hours before death, a hot iron was held on the outside of the hip joint; and half an hour after death a red-hot poker was applied to three places on the inside of the arm. Vesication followed the burns in both instances, but those caused during life contained serum, and those which were formed after death *air*. In a second experiment a cauterising iron produced no blisters on a leg half an hour after amputation, but vesications containing air were formed when the iron was applied ten minutes after amputation. On the whole, Christison thought that a vesication containing serum indicates a burn during life, and one containing air a burn after death. Taylor performed somo experiments on the bodies of infants eighteen and twenty hours after death, both with boiling water and heated solids, but in no case did he observe any kind of vesication to follow at that period. The skin was shrivelled, and was partly destroyed by the heat, but there were no blisters produced.

In certain morbid states, blisters containing serum are alleged to have been produced in the dead body even twenty-four hours after death.

Leuret observed that this took place in a dropsical subject in the vicinity of which a heated brazier had been placed. The cuticle was hardened, then raised and blistered, and the blister contained an abundance of reddish-coloured serum. In repeating this experiment on other dead bodies not infiltrated, it was observed that no vesications containing serum were produced. Champouillon found that blisters may be produced in bodies affected with general dropsy at almost any period after death. The blisters did not appear immediately; the time which he found requisite for their production varied from two to six hours. The serum effused beneath the raised cuticle was rarely tinged with blood.

The conclusion to be drawn from these experiments is that, in the examination of *burns* on the body of a person affected with general dropsy, it is necessary to be cautious in expressing an opinion. In such cases it would not be possible, from the existence of mere vesication, to say whether the burn took place before or after death.

Liman, in experimenting with dead bodies, noticed that by a spirit flame, a blister might be raised, but that it contained nothing more than vapour derived from the fluids of the skin beneath the cuticle. It soon became flat and charred, and there were no changes in the surrounding skin indicative of vital reaction. The temperature (of the bodies) varied from 78° F. to 98° F. No experiments were performed on the bodies of persons dying or just dead. It is, therefore, exceedingly doubtful whether, except under special conditions of the body such as general dropsy, blisters containing serum can be produced by a burn on the skin of a person really dead. Christison found that when boiling water was poured upon a dead body *ten minutes* after death, the skin was simply ruffled and shrivelled, but the cuticle was not raised into a blister. The same effects were produced so long as the body retained its warmth. It is improbable that any effects closely resembling an *ante-mortem* blister can be produced by heat applied after death.

Chambert has published the results of numerous experiments on the effects of burns on the living and dead body. These were made on the bodies of persons from the moment of death until twenty hours after dissolution, and some were performed before death. The general results of his researches are—that blisters may be produced by burns, both on the living and dead bodies; that they are produced at a lower temperature in the living than in the dead; that in the living a burn produces great capillary congestion, with effusion of serum in the blisters, and that this serum, when heated or treated with nitric acid, sets into a nearly solid coagulum. The blisters produced in a dead body, even a few minutes after death, contained **a thin watery serum,** which was only rendered opaline or milky by heat or nitric acid, *i.e.*, contained but very little albumen compared with the fluid obtained from the blister of a burn during life.

Signs of Congestion. In burns, especially in those produced by red-hot solids, other effects besides vesication follow. The edge of the skin immediately around the burnt part is commonly of a dead white, and close to this is a *deep red line*, gradually shaded off into the surrounding skin, which is reddened. The diffused redness is removable by pressure, and disappears with life : the red line here referred to, however, is not removable by pressure, and is persistent after death. This line of redness is not always met with in severe burns, and when a person survives one or two days, its production appears to depend upon a power of reaction in the system. Thus, then, its absence furnishes no proof of the burn having been produced after death, for it is not a necessary accompaniment of a burn during life. Christison endeavoured to determine by experiment whether this line of redness could be produced by applying a heated iron to a dead body. He found that when the person had been dead only *ten minutes* no such effect was produced. In repeating his experiments on bodies many hours after death, Taylor found that no line of redness ever presented itself ; so that its discovery in a dead body burnt would appear to indicate either that the burning took place during life or within a few minutes after death, most probably the former. In one case, the fact that certain burns on the body had been produced during life was determined from an observation of this sign. The deceased was found dead with his skull extensively fractured, his throat cut, and his body burned in various places. It was remarked that the burns were surrounded by a line of redness ; that they were probably produced about the same time as the other injuries, but certainly while there was some vital action in the system. When, however, vesication and a line of redness are absent, there was no naked eye data on which to found an opinion whether the burn was caused before or after death. Wright considered that in a low state of vitality a line of redness might not be produced by a severe burn on the living body, and that more reliance might be placed on the red marks found beneath the blisters and crusts of vital burns. These latter were well marked when the line of redness itself was indistinct. The researches of Chambert confirm this view. In a burn on a living person if the skin has not been entirely charred and destroyed, the cutis will present a dotted or pointed redness, these dots or points corresponding to the sweat glands and hair-follicles. After death, the burn does not produce any such effect ; the cutis is of a dead white on its surface and in its substance. In one experiment, performed ten minutes after death, there was no redness of the skin either beneath the blisters or in the surrounding parts. This reddened or congested state of the bare skin is more constant than any other appearance, and in conjunction with the presence of blisters, forms the best criterion of the infliction of a burn on the living body.

It seems probable that the red line owes its appearance to those changes in the blood which have already been referred to, coupled with something of the nature of a fixation of the albumen of the corpuscles by heat. Though there is no sharp line of demarcation between them, it is important to note that this red line is not quite the same thing as the inflammation which occurs at the edges and on the surface of a burn when the victim survives for some time ; the degree and the stage of this inflammatory reaction is of importance in estimating the length of survival.

A microscopic examination of the injured tissues should be made in order to ascertain whether there are any signs of vital reaction or infiltration with leucocytes, which prove that the burns were sustained during life.

The presence of carbon monoxide in the blood, the presence of carbon particles in the lungs, and the observation of toxic changes in the cells of the viscera are most important points in deciding whether the person was alive or dead when the fire occurred.

How long did the Victim survive the Burns? When *several burns* are found on a dead body, it may be a question whether they were all produced at the same time. This is a point which can be determined only by observing whether any of them present signs of gangrenous separation, of suppuration, granulation, or other changes that take place in a living body after accidents of this kind. The witness may be asked, how long did the deceased survive the burn? A person may die in a few minutes or live some hours after receiving a most extensive burn, and yet there will be little change in the part to indicate when death actually took place. There may have been no time for inflammation or its consequences to become established. Suppuration generally follows vesication, and in severe cases it may occur on the second or third day, but often not until a later period. In regard to gangrene, this takes place when the vitality of a part burned is destroyed. The time of its occurrence is uncertain, but it sometimes very speedily follows the accident.

All that can definitely be said is this: inflammation can occur only in *living* tissues; therefore, if it is present, the patient must have survived long enough for reaction to set in. The stages of inflammation are variable in the rapidity with which they appear or follow one another, and therefore a very guarded opinion must be expressed as to the exact duration of life after burning; only an approximate estimate should be given in such cases.

The conclusions which we may draw from the foregoing statements are—(1) that when we discover marks of vesication, with effusion of serum or a line of redness about a burnt part of the body, we are justified in saying that the burn has occurred during life; (2) that when these appearances are not met with, it by no means follows that the burn has not been produced in the living body, the affirmative evidence derived from such appearances being much stronger than the negative.

What extent of burning is necessary to kill? We have already discussed the actual causes of death from burns and seen that they are (1) if death follows within two or at most three days, shock; (2) if within three or four days, a curious acute form of toxæmia; (3) if at a later period, general exhaustion and septic absorption. Now as regards shock, it is impossible to say what extent of burn would or would not produce shock or pain of sufficient intensity to kill, nor is it possible to say what degree of shock might not arise from the act of burning. In the other two modes of death (and indeed in shock), there is no doubt but that the extent of superficial area of skin burnt is of much greater importance than the depth to which a burn extends—the greater the area the greater the risk—and it is usually laid down that if one-third of the total skin area is involved in a burn sufficient to blister or scorch, the prognosis is exceedingly grave and that much smaller areas are dangerous. Beyond this general statement it is impossible to go.

Are there any certain indications that death was due to burning? We have given an account of the *post-mortem* appearances above, and it must be stated that there is nothing which can be said to be characteristic and pathognomonic of death *from* burns. If there be the fact of burns on the body, and the fact of death, and the fact that no other cause for death has been found, we are justified in stating these facts, but it is obvious how far they are from proving death from burns; poisons may easily be overlooked, to say nothing of destruction of strangulation marks, etc. The finding of CO-hæmoglobin suggests asphyxia from that gas, which is commonly found in fires; it proves no more than that the person was alive and breathing during the fire.

Are there any other appearances to account for death? The only means by which this question can be answered is obviously to perform the necropsy with scupulous attention to the details of wounds, signs of poisoning or strangulation or of any other form of violent death.

In a case of death from burning, the lungs were congested, and the cavities of the heart were empty. No particular observation was made as to the colour of the blood. The tongue was swollen, and there were some other appearances indicative of strangulation, so that the burning had probably been resorted to in order to conceal the mode of death. There was a blister or vesication on the top of the chest, showing that when the body was burnt it retained some degree of vitality. The eyes were much suffused. A case under "Strangulation" is another illustration of a similar event.

Under the appropriate heading will be found a full account of the appearances found corresponding to each form of violent death, and they need not be recapitulated. The difficulties that may arise are of course due to the fact that the burns may have implicated just the parts concerned and so destroyed all evidence.

WAS THE BURNING THE RESULT OF ACCIDENT, SUICIDE, OR HOMICIDE?

Death from burning is so painful and repulsive to the sane mind that **suicide** by this means in England is extremely rare, except among the insane. Cases are from time to time reported, however, of persons who saturate their clothes with paraffin or petrol before setting fire to themselves. In the East it is by no means an uncommon method of suicide.

Accidental burning accounts for a very large proportion of all burns. Ignition of the clothing in adults, especially females, and trying to drink from a kettle of boiling water in children are very common causes of burns and scalds; breaking of cheap lamps, with explosion of the cheaper oils, is another fertile source, as is explosion of Primus stoves; workers in molten metal works are often severely burned, fires in houses and places of entertainment often produce a terrible holocaust of victims. In all these cases there is almost invariably sufficient circumstantial and direct evidence to clear up the origin of the mischief. In connection with such evidence, Crookshank communicated to the Medico-Legal Society in 1909 a case in which the body of a child found in the Thames, showed very clearly the marks of the hot bars of a fire-grate, but he was unable to suggest whether this was accident or homicide.[1]

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[1] Crookshank, Essays, 1911, p. 232.

It should be noted that the Children and Young Persons Act, 1933, s. 11, makes it a punishable offence to leave a child in a room in which there is an open fire which is insufficiently protected.

In comparison with these accidents, direct **homicidal burning** is rare, but plenty of cases are on record where hot metals, scalding water, and corrosive substances have been used with criminal intent. Thus—

A singular case occurred in which the mother of an idiot, wishing to get rid of him, poured melted pewter into his right ear while he was lying asleep. Great pain and violent inflammation followed, but the idiot recovered. The mother then alleged that he had himself poured the melted metal into his own ear.

In *R.* v. *King*, a woman was convicted of throwing boiling water over her husband, with intent to maim him. In *R.* v. *Blewitt*, the prisoner was convicted of the manslaughter of his wife by pouring over her the contents of a kettle of boiling water. In *R.* v. *Hill*, the accused was convicted of feloniously casting boiling water over a man, with intent to do him grievous bodily harm. The medical evidence was that the scalds were on the head, cheek, neck, and arm, and were of a dangerous nature. A woman in Glasgow attempted to kill her husband by pouring boiling water over his genital organs while he was asleep in bed. He died, but his death could not be clearly attributed to the scalding.

An Irish labourer was tried for the murder of his infant daughter. The evidence showed that in a drunken fury, the prisoner poured boiling water on the child. The jury found prisoner guilty of manslaughter, and he was sentenced to three years' penal servitude. The judge said that if prisoner had been in England he would have been convicted on the capital charge.

From time to time cases occur in the police courts in which a man in drunken fury pushes or throws his wife or child on the fire, and also cases in which lighted lamps are used as missiles to throw at an offending party.

Direct and deliberate attempts to burn a victim to death in the same sense that a murderer may stab, shoot, or strangle him are practically unknown.

Medical evidence may give rise to a suspicion of murder under two conditions : (1) when it is evident that several parts of the body have been burned at the same time, and the burns are not such as can readily be explained by the same accident, or by an accidental ignition of the clothes ; (2) when there are marks of homicidal violence on the body, (but such marks, if we except fractures of the bones, may be easily effaced when the burn is extensive). In investigating a suspicious case, we must remember that the fact of a dead body not being found near a fire or any substance capable of causing ignition does not necessarily justify an assumption of murder, since the deceased, unless disabled by intoxication, infirmity, or disease, has the power of running away from the fire after an accident, and may be found dead at a distance without having been seen by any person.

Illustrative Cases

The following cases are illustrative of some of the various points raised :—

Difficult Case of Accident or Homicide. On the night of the alleged murder the prisoner was in bed, when his wife returned home with a lighted candle and some whisky, which she had procured from a neighbour. Some time after, a struggling was heard in the apartment, and when this had subsided a smell of fire was perceived to issue from it. The neighbours now endeavoured to obtain admission by knocking at the prisoner's door, but he either could not or would not hear them. At last a man forced his way in by breaking the window of the outer room. On entering, he found the room full of smoke and something burning in a corner, over which he instantly threw a pitcher of water; this proved to be the body of the deceased. Several persons then entered the inner room, where they found the prisoner either asleep or feigning to be so. On being aroused and told that his wife was dead, he expressed neither surprise nor sorrow, but coolly demanded by what authority his neighbours had broken into his house, and threatened to send for a constable. On an examination of the body, some parts were found completely carbonised by the action of the fire. On the face and extremities, however, the fire had not acted with such violence, and on these parts were found marks of vital reaction, indicating that the burning had taken place during life. Some spots were merely red and inflamed, others scorched to a hard transparent crust, but surrounded by a distinct redness; there were also many vesications filled with serum. From these appearances the witnesses gave it as their opinion that the deceased had been burnt to death. The jury, in this case, returned a verdict of not proven, considering probably that the deceased might have been accidentally burnt.

It is to be hoped that the following will remain a rare case :—

A man and a woman were charged with cruelty to a child aged seven years. It was alleged that the woman was guilty of cruelty and that the man must have been cognisant of it. An inspector of the National Society for the Prevention of Cruelty to Children stated that the child had been burned in the hand with a flat iron and on the soles of the feet with a poker. The magistrates described the case as deplorable, and sentenced the woman to six months' and the man to three months' imprisonment, each with hard labour.

The following is a somewhat unusual case of burning :—

A girl of sixteen was charged with manslaughter. She had come home late at night, and her mother rebuked her—with a sweeping brush—for keeping late hours. The daughter declared that if she was again struck she would kick over the paraffin lamp, and on the blow being repeated she carried out her threat. A little brother, six years of age, was close at hand; the lamp fell near him, set his clothes on fire, and he was so seriously injured that he died. The indictment was thrown out by the grand jury on the ground that there was no malice towards the victim.

In *R.* v. *Rouse*,[1] the accused was charged with the murder of an unknown man whose charred remains were found in a burnt-out motor car at a village near Northampton, on November 6th, 1930. The car was destroyed, and certain of the brass parts had been melted by the intense heat. The body in the car was lying face downward, with the face on the driver's seat. It was lying with the right arm extended and lifted, burnt up to the elbow and the left arm was not to be seen.

Part of a pair of braces taken from the body, smelt strongly of petrol.

A dirty mallet was found near the car, and three human hairs were found adhering to the mallet by means of the dirt.

The evidence showed that the fire was designed.

In the opinion of the medical witnesses there was evidence that the dead man was alive in the blazing car a short time at least while the fire raged, and that he continued to breathe for some time after the fire began.

In Sir B. Spilsbury's opinion, carbon monoxide had been produced in the course of a fire, but had not been inhaled for long because it had not had time to get into the blood in any appreciable amount. He thought that the victim must have died within about half a minute after the fire started. The effect of the intense heat upon the limbs would be to produce heat stiffening or heat rigor. Death had taken place from shock due to burns. The fact that the skull had been splintered was undoubtedly due to the heat.

The prisoner was found guilty and sentenced to death.

Murder of Walter Spatchett by Samuel James Furnace. Furnace committed suicide on January 17th, 1933, by taking spirits of salt after he had been arrested on a charge of murdering Spatchett whose body was found shot and partly burnt in a shed at Chalk Farm on January 2nd, 1933.

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[1] Northampton Assizes, January, 1931.

After he was charged, Furnace made a statement to the police to the effect that after he had shot Spachett he put the body in the office chair in the shed and poured oil and paint over it. He then " stood a lot of paper on the floor and stood a candle in the middle of it." He lit the candle ; pulled the outer door to, and locked it. Then he wrote a note, suggesting that he had committed suicide, on a paper pad, and put it in the shed.

The cause of Spatchett's death was a penetrating wound caused by a bullet which had passed from the left side of the back to the right side of the front of the chest.

The shot was fired from behind ; the bullet entered the right ventricle of the heart, and emerged on the right side of the chest. The wound at the back had fairly clean-cut edges and was slightly oval. It was surrounded by a darker ring of slightly reddish bruising. The wound in the front was rather irregular and was not bruised.

Death being almost instantaneous, the victim was dead when he was burned. The body was seated in the chair, and was partially covered with remains of clothing, but had been largely destroyed by fire. The burning was far more marked on the front than on the back, and the arms and legs were very much burned.

TIME REQUIRED FOR THE BURNING OF A DEAD BODY

It may be a medico-legal question whether, on discovering a body much burned, it could be determined from its appearance how long a period it would require to produce the amount of destruction observed. An answer to such a question may be necessary, in order to connect a person with the perpetration of an alleged crime, but the question does not admit of a precise answer. A conjecture only can be formed from the facts proved in each particular case. The human body contains a large proportion of water (72 per cent.) ; this gives to the soft structures a power of resisting combustion. At the same time there is a quantity of fat in the body, varying in different parts, but amounting to an average of about 5 per cent. The fat or oil tends to increase its combustibility, and this is still further increased if it is placed on any combustible article which can imbibe it, such as a rag or a deal floor. The nature of the clothing will also make a difference. Under a strong and active flame, which might subsequently burn out before the discovery of the body, there would be a degree of destruction in half an hour which a mere slow and smothered combustion would not effect in several hours.

This question actually arose in *R.* v. *Hatto.*

The deceased woman was found dead in her room, and her body much burned. She was last known to be living at about a quarter-past eight o'clock in the evening, and her body was found, still smouldering with fire, on the floor of the room, at about a quarter-past eleven o'clock. The only persons known to have been in the house were the prisoner and the deceased. The medical man who examined the deceased found that " both knees were consumed by fire, and the thighs, as well as the private parts, were burnt to a cinder, leaving the shafts of the thigh-bones exposed and charred for several inches. Between the thighs and the feet, the floor underneath had been burnt away, and the leg-bones had fallen through the floor, leaving the feet unburnt on the floor." He expressed an opinion that it would take from two and a half to three hours in order to consume the body to this degree, thus covering the whole interval during which deceased and prisoner were in the house together. The clothing of the deceased was much burned, and beneath the body there was a hempen mat which became highly combustible, owing to the melted human fat with which it was impregnated. The guilt of the prisoner was fully established from other circumstances which were quite inconsistent with his innocence.

It is obvious that an opinion on such a subject must be in all cases conjectural, since the effects, *Cœteris paribus*, depend as much on the intensity as on the duration of the heat. It was indeed just as probable, medically speaking, that, with a large body of flame, the amount of injury met with might have been produced in an hour as in three hours. The confession of the prisoner, subsequently made, shows that the burning observed must have taken place in less than two hours, and perhaps within an hour and a half.

The case of the Countess of Goerlitz, too, is of more importance in this connection than as supporting the hypothesis of *spontaneous* combustion (*vide* below), which was seriously advanced. The confession shows its absurdity.

The trial took place at Darmstadt in 1850. A valet was charged with the murder of his mistress, who was found dead in her room; the clothing on the upper part of the body was almost wholly consumed; the head exhibited the form of a nearly shapeless black mass, in which the mouth was imperfectly distinguishable, with the charred tongue protruding from it The skin of the neck, as well as the skin and muscles of the face and upper part of the chest, was much blackened and charred. The joints of both arms were charred on their surfaces, and the blackened ends of the bones protruded. There were no marks of fire anywhere on the clothes beyond the margins of the burns on the body. A writing-desk near the body had been partially burnt, and the floor beneath and in front of the desk, over a space of a foot and a half, had been entirely consumed. The feet of a chair placed near the writing-desk were slightly charred. A folding-board and the drawers were also much burnt. It was proved that she had retired to her room between three and four o'clock in the afternoon, that at seven there was no burning in the room. Between seven and nine p.m. a bright light was observed through the window and smoke from the chimney. There is a little discrepancy as to the time, but taking the maximum, the amount of destruction described in this case must have occupied less than two hours, and probably not more than one hour. When the room was first broken into, and the countess was found dead, flames burst out simultaneously from the hangings, the writing-desk, and the floor beneath it, which required to be extinguished by water. The countess was thus found dead in her room on June 13th, 1847. The body was exhumed on August 11th, 1848, for purposes of inquiry. The Hessian Medical College, to which the case was referred, came to the conclusion that the countess had not died from spontaneous combustion. The case was subsequently referred to Liebig and Bischoff; and their report was issued in March, 1850. They found no difficulty in concluding that the body had been wilfully burnt *after death* for the purpose of concealing the murder. There was some doubt whether the deceased had died from strangulation, or from violence to the head. The valet subsequently confessed that the countess had entered her room as he was in the act of committing a robbery. A struggle took place; he seized her by the throat; strangled her, and afterwards placed the body in a chair, piling around it combustible articles of furniture. He set fire to these with the view of destroying the proofs of his crime. It will be observed that the tongue was found protruded, as it is in violent strangulation, and that in its charred state it retained the position given to it by the act of murder.

These cases and some others prove that a short period may suffice for a large amount of destruction, and that, judging by what remains, the combustible materials consumed appear to bear only a small proportion to the parts of the body burnt. This may be accounted for by the large volume of flame produced during the combustion of articles of female clothing.

In motor car accidents the intense heat given out by the ignition of the petrol may cause destruction of a great part of the body in a very short time.

The Superintendent of the Woking Crematorium has supplied the following information concerning the heat required in cremation :—

The average time required for the complete incineration of an adult body, if enclosed in a coffin, is an hour and a half but without coffin one hour; providing the temperature of the incinerating chamber is up to 1,800° F.

B. General Exposure to Heat

The effect of an intensely heated atmosphere in causing death has been extensively studied experimentally since the time of Bœrhaave.[1] All experiments have shown a definite, often pronounced, hyperpyrexia of the body, associated with changes in the blood and circulation, in respiratory exchange, and in the nervous system, the actual cause of death being referred either to the sudden stoppage of the heart from coagulation of the myosin, the change in the blood, or the paralysis of vital nerve centres. It is doubtful whether experimental results in animals can be utilised directly to explain the effects of exposure to high degrees of heat in man, owing to the difference that exists between man and other animals in regard to the excretion of sweat by the skin as a heat regulating mechanism.

Direct observations on man are more valuable, either under experimental conditions, or in the course of everyday life in the tropics, or in the engine rooms of steamers, or other places of employment characterised by high temperatures. There is no doubt that a healthy, robust man can be rapidly acclimatised to work in high temperatures without harmful effects, providing an adequate intake of fluid and salt is maintained. The acclimatisation would appear to consist of an increased cardio-vascular efficiency with decreased production of heat, and also of increased loss of heat by sweating.

On the other hand, an attempt to work under similar conditions may prove disastrous to the individual who is not acclimatised, or who is rendered susceptible by the presence of any of the known pre-disposing factors, which include alcoholism, fatigue, active disease, especially of a dehydrating nature, or a heat regulating mechanism already disturbed by recent fever.

Apart from the temperature of the atmosphere, the most important external factor is the degree of saturation of the atmosphere with moisture, and an increase in the atmospheric humidity may produce heat effects even in those apparently acclimatised.

Heat exhaustion is the term usually applied to syncopal attacks due to excessive heat. Such attacks are seldom serious.

Acute heat stroke, or sun stroke, is characterised by collapse, sometimes with immediate unconsciousness and death. In other cases, progressive mental confusion and delirium may gradually deepen into coma. Convulsions may occur. The face is congested, and the skin is dry and hot. The temperature is high, from 105° or 106° F. up to 110° F., or even higher as the case progresses to a fatal issue. Clinically, the case may resemble meningitis, but the cerebro-spinal fluid is usually normal in appearance and rarely under raised pressure.

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[1] "Elementa Chemiæ," Leyden, 1732, I.

More commonly, however, there is a preceding apyrexial period of headache and lassitude, giddiness and nausea, insomnia, and mental dullness or irritability. If these symptoms are recognized, appropriate measures may prevent the development of a serious or even fatal attack of acute heat stroke.

The post-mortem findings in fatal cases of heart stroke are by no means pathognomonic. Marked venous congestion of the viscera is usual. Pulmonary œdema, often hæmorrhagic, and multiple small hæmorrhages throughout the body are other findings frequently made. Search should be made for the presence of such small hæmorrhages in the brain. The cause of death is probably circulatory failure of central origin, but the mechanism responsible cannot be regarded as fully understood.

The condition of heat cramps, frequently occurring in the engine-rooms of ships in the tropics, is due to excessive loss of chlorides by sweating. The muscle cramps are accompanied by headache, dizziness, and vomiting, and occasionally the condition may complicate the picture of serious heat stroke. Treatment and prevention both consist of maintaining the intake of fluids and chlorides. By examination of the urine, a valuable indication of the body's chloride content can be obtained. Elimination of less than 3.0 grammes of chloride in the urine passed during twenty-four hours is stated to indicate a dangerous depletion of chloride in the body.

Medico-legal Relations of Heat-stroke. A few cases have come before the courts in which heat-stroke has figured in claims by workmen for compensation. The reader is referred to text books on compensation for details of such cases.

SPONTANEOUS COMBUSTION

It is nearly a century and a half since the hypothesis of the spontaneous combustion of the human body took its origin. The medical witness must be careful, however, to note the word *spontaneous* in connection with the hypothesis, for it is the idea contained in that special word which is so opposed to any known facts in connection with the human body. Chemists are aware of a few circumstances under which ignition does spontaneously arise from the juxtaposition of two bodies (pure potassium and water, for example), neither of which need be even warm ; but assuredly no such bodies have ever been found, nor ever arise, in the human body in ordinary conditions nor in any conditions known to science.

While thus absolutely rejecting any doctrine of spontaneous combustion, it must be admitted, on the other hand, that there are cases recorded by credible authorities which require some explanation to account for the unusual amount of destruction (burning) which has been produced in a human body by what are at first sight very inadequate means ; a doctrine has hence arisen that in certain circumstances the body does acquire properties of preternatural combustibility.

In all such cases, a candle, fire, or some ignited body has been at hand, and the accidental kindling of the clothes of the deceased has been at least a possibility, if not a probability, and no further explanation has been required of the *origin* of the fire; but the amounts of destruction of the body compared with that of surrounding objects has certainly in some cases been remarkable. Before attempting any explanation we may quote a few illustrative cases :—

Ogston, sen. and jun.,[1] relate the two following cases of preternatural combustibility which came within their own experience. A woman, aged sixty-six, of intemperate habits, was left in her house alone. An hour later her body was found on the third step of the stair near the kitchen; the step on which the corpse rested, and one of the spokes of the wooden hand-rail, being charred, as were the seat of a chair and a small portion of the front of a straw mattress on a bed, both of which were in a kitchen on the same floor and adjoining the staircase. Contrasted with this moderate amount of combustion exterior to the woman's body was the extent of its effects on herself. On the front of the head and face the absence of the soft parts left the exposed bones blackened and calcined. On the back of the neck and chest patches of a greasy charcoal were found here and there; and, beside them, the spinal column and several of the ribs were exposed and burned black. The abdominal wall was wanting, the intestines a burned and blackened mass, and the surface of the liver calcined. The upper limbs were distorted, the elbows strongly flexed, and everywhere charred to a great depth; the bones, however, even of the fingers, preserving their position. The right thigh had its deeper muscles still uncharred, but presenting the appearance of roast beef, and was very dry. The skin and superficial muscles were completely burnt away. The right leg, only partially attached to the thigh, was entirely converted into a greasy black charred mass, even the bones not escaping. The right foot, totally detached from the leg, had been changed into a soft, black, greasy, and shapeless cinder. The left thigh, leg, and foot were in a condition similar to the right. Not a vestige of clothing remained anywhere. In the second case a woman, aged sixty, was left by her husband in bed apparently in her usual health. Three hours later smoke was noticed issuing from the room, and the woman was found dead close to the fireplace, in which there were then only a few nearly extinguished embers; her nightdress, her only clothing, was on fire. It was supposed that two hours previously, and an hour after her husband had left her, the deceased had got out of bed to light the fire in her room. The whole of the right side of the body was more or less burned, the burns being in all stages, from mere reddening of the skin to its complete destruction, along with that of the flesh underneath it. The flesh of the right arm was charred down to the bones, and the elbow joint was laid open. The superficial muscles of the right thigh were burned away, and the deeper muscles roasted. The right side of the face and head were charred. The right breast was roasted. There were burns of the first and second degrees on the left arm and hand. The belly was much swollen.

In both cases the combustion appears to have originated from the ashes in the fireplaces, but, in the opinion of Ogston, they seem insufficient to account for the extreme destruction of the bodies without supposing that they were in a state of unusual readiness to support combustion.

The following case occurred in France :—

The body of a man was found lying in bed, and in a state of combustion, the chamber was filled with a dense smoke, and one of the witnesses asserted that he saw a small whitish flame playing around the body of the deceased, which receded from him as he approached. The clothes of the deceased and the coverings of the bed were almost entirely consumed; but the wood was only partially burnt. There were no ashes, and there was but a small quantity of vegetable charcoal; there was, however, a kind of mixed residue, altered by fire, and some pieces of animal charcoal, which had evidently been derived from the joints. The deceased was in the habit of carrying lucifer-matches in his waistcoat pocket; and, according to his usual practice, he had had a hot brick placed at his feet when he went to bed the preceding evening. Two hours afterwards his son and daughter-in-law passed by the door of his room, but there was nothing which attracted their attention. The deceased was seventy-one years of age. He was not fat, nor was he addicted to drunkenness. The temperature of the air was low; and there were no electrical manifestations. The son and his wife were suspected of having murdered the deceased, and afterwards burnt the body in order to conceal the traces of the crime. The body, which had been buried, was exhumed and examined. The partially burnt cravat was still around the neck, and part of a sleeve of a nightshirt was found. The hands, completely burnt, were also attached to the forearms by some carbonised tendons, which gave way on the slightest touch. The thighs were detached, so as to resemble a wilful mutilation, but for the discovery of animal charcoal about them. From these facts, Masson considered it impossible to ascribe the changes to the effect of accidental burning; and as they could only be produced by combustion continuing for some time, he drew the inference that the burning must have resulted from some inherent cause in the person, probably roused into activity by the hot brick placed at the feet of the deceased. The burning once commenced, would be easily supported by the state of the tissues. Hence the case was, in his opinion, to be referred to the class of spontaneous combustions. Orfila is reported to have coincided with Masson in this opinion, and the accused were acquitted.

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[1] "Lect. on Med. Jurispr.," pp. 463, 559.

The following is quoted from Mann, as recorded in the *Medical Chronicle*, 1891 :—

In a case reported, with a history of the subject, by Reynolds, the abdominal wall was charred completely, and there was a large hole about eight inches long in the middle line; the face was crimson as from fire, but not blistered; the hands, stretched above the head, were unburnt; the arms were burnt and blistered, but not blackened; the thighs were burnt to the bone as far as the knee, where the burning abruptly ceased. It is evident that the combustion started in the abdomen, and in this instance spread further down than is frequently the case. The woman was lying on her back with the thighs and knees well flexed, so that the former would be brought into close contact with the abdomen, and would, therefore, be subject to the full play of the flames; the effect of the heat on the anterior muscles of the thighs would be to shorten them, and thus, in the first instance, to draw the thighs more closely towards the abdomen. The burning had taken place either before or immediately after death, as blistering with signs of inflammation was present on the surrounding parts.

A woman addicted to drinking alcoholic liquids to excess, including absinthe, having drunk largely, went into her bedroom, and two hours afterwards her husband, in attempting to enter the room, found the door so hot that it gave him a sensation of burning. An alarm of fire was given, and the room was entered by a window. The dead body of the woman was found on the floor between the bed and the hearth —the head being partly under the bed, and the legs across the hearth. There was no fire in the grate, and the register was down. The floor on which the body was lying was more carbonised than burnt, and on it were found fragments of bones —some of the ribs, a hand, and incinerated remains. The head, which was swollen and of a violet-red colour, presented no mark of burning. The hair was not burnt. The upper part of the trunk was not burnt, but was covered with a black powder, the residue of the burnt clothing. The left arm had disappeared from the shoulder. The right arm had lost the hand, which was disarticulated at the wrist. The elbow joint was exposed, but the muscles of the arms were not destroyed. The left side and front of the chest were widely open, but there was no trace of the thoracic viscera. The lower ribs were separated. The walls of the abdomen were gone—its cavity was empty, the viscera being reduced to a greasy black root adhering to the vertebræ. The bones of the spine and pelvis remained, but the muscles and fasciæ had disappeared. The lower limbs from the thighs downwards were entire, the skin being covered with a black powder—but there were no blisters or vesications on these parts. It is further stated that although there was no visible source of fire or ignition in the room—and the bed and its furniture had escaped burning—the floor was still burning, but without flame, when the room was entered. No combustible in the form of candle, matches, or fuel was found near the body. No noise or cry of alarm was heard, and the people living opposite saw no light or ames in the chamber or smoke issuing from it.

The complete destruction of the clothes by burning in this case shows that the fire was *ab extra* while the localisation of the burns to the body, the absence of singeing of the hair, the quantity of carbon particles about the body and other circumstances suggest the probability that a highly inflammable liquid had been used to saturate the clothes. It is very difficult to imagine how such a case could have occurred from accidental causes.

What, then, can be offered as the explanation of such cases ? Their occurrence has been recorded with considerable detail and the following points may be considered in connection with them :—

(*a*) Experiments.
(*b*) Influence of alcohol.
(*c*) Influence of gases in the living.
(*d*) Influence of gases formed after death.
(*e*) Influence of fat.

(*a*) **Experiments.** Taylor, in early editions of this work, stated : " Dry animal solids readily burn, but the soft parts, either in the living or recently dead body, contain as much as 72 per cent. of water, which renders them highly incombustible. Until a large proportion of this water is evaporated, the substance does not undergo combustion. In many experiments made on different organs and on different bodies, the author has not observed that different parts of the same body or the parts of different bodies have varied in their degree of combustibility The bones alone have withstood a greater degree of heat, from the large proportion of earthy matter contained in them. The experiments have led to this result—the flesh and the organs generally are very difficult of combustion, and can be completely consumed only in a strong fire and under a powerful current of air. Experiments on the bodies of animals have shown that they possess the same property of difficult combustibility. The presence of alcohol in flesh does not render it combustible. The alcohol will burn, but the flesh can only be burned by removing from it the substance which interferes with its combustibility —namely, water. Tissues which have undergone extensive fatty degeneration may, nevertheless, become unusually combustible, so as to burn readily on the application of the moderate heat of a spirit lamp."

(*b*) **Influence of Alcohol.** While it is generally observed that the bodies which seem to be unusually combustible are those of persons who, during life, were much addicted to alcohol, and had consequently become very fat, and that the fatal accident generally happens when the victim is very drunk, it is quite certain that the alcohol plays no direct part in combustion. Alcohol absorbed by a person in quantities sufficient to kill him could not possibly have the slightest effect on combustion.

(*c*) **Influence of Gases in the Living.** A case is recorded in which a man set fire to his breath in blowing out a match ; and another case in which the gas issuing from some vomit was set on fire. We thus have proof that, even during life, gases may be formed in the alimentary canal which are capable of igniting on the application of a flame ; and such might also continue to be formed after death.

(*d*) **Influence of Gases formed after Death.** Many bacteria have the property of evolving gases which are inflammable. The ignition of such gases might cause a certain amount of destruction of the tissues and clothing.

(*e*) **Influence of Fat.** It has already been noted that the bodies which are unusually combustible are usually fat. Fat burns readily when once it is ignited, and it is possible that the clothing and the fat of the body may act as the wick and the tallow in a candle respectively.

Medico-legal Relations of Unusual Combustibility

In this connection the admission of the existence of unusual combustibility may be very important, for it may be made the basis of a defence in certain cases. It frequently happens that the skin is much injured by fire, while the muscles and soft parts beneath have suffered but little. There are some circumstances which may occasionally explain the varying extent to which parts of a body are found burnt. An assassin may have employed petrol, benzine, paraffin, methylated spirit, turpentine, or other inflammable liquid, of which no trace can be found; and the great destruction of the body may, therefore, be due to this extraneous cause, and not to any increased combustibility of its parts. A short exposure to a large volume of flame, owing to its high temperature, will speedily char the flesh and consume it. Articles of female dress, from the quantity of air enclosed between the layers, are capable of producing a considerable volume of flame, and thus the bodies of women are sometimes extensively destroyed, as a result of the accidental burning of the clothes. Even allowing that parts of the human body might, in certain cases, acquire increased combustibility, the medical witness will perceive that this admission does not involve any difficulty in the judicial determination of murder by burning, since the combustion of a body cannot possibly take place except by contact with some substance already in a state of combustion. But whether the ignition of the clothing of a deceased person took place accidentally, or by the criminal act of another, is a totally different question: it can be cleared up only by general and circumstantial evidence. Assuming that the body of one person will burn more rapidly and completely than that of another, this will be no answer to a charge of causing death by fire.

A defence of spontaneous combustion, if admitted, might prove most convenient to assassins. In the case of Mrs. Pulley, whose body was examined in 1860, the circumstances were such as to require little ingenuity to transform them into a *prima facie* case of spontaneous combustion, although a proper inqiry showed that it was a deliberate murder by strangulation. There was a subsequent burning of the body by means of the clothing, in order to remove the signs of a violent death.

The deceased was found lying on the hearth of her room, about three or four feet from the grate. From the shoulders downwards the body was lying on a boarded floor of oak. The deceased was fully dressed, and parts of her clothing and body had been destroyed by fire. A brass candlestick was lying between the left arm and the body, the top of the candlestick being inclined towards it. The clothes were wholly burnt off both arms, and partly off the upper portion of the trunk. The legs were not at all burnt. A bonnet which the deceased wore was partly burnt. The right arm was elevated by the side, with the elbow resting on the floor. The fingers were partly burnt off, and the remainder of the hand was charred. The left hand, which was stretched out, was not so much burnt as the right. Some ashes from the clothing lay between the left arm and the body. The burning had ceased, but there was a strong smell of burning in the room. There had been no fire in the grate. Under the body there was a hole in the oak floor, which had been produced by burning. The features were distorted and swollen, and the eyes suffused with blood. Some parts were burnt to a cinder, whilst others were but little affected by the fire.

BURNS FROM X-RAYS

Over-exposure to X-rays may produce damage to the tissues of varying degrees of intensity depending on the strength of the dose, the period of exposure and the type of tissue irradiated. When over-exposure is slight, the skin becomes inflamed and reddened, but after a short period, this passes away, leaving only a slight bronzing. When there is a higher degree of over-exposure the skin may blister and there may be atrophy of the superficial tissues and obliteration of the superficial blood vessels. As a result the tissues become very susceptible to slight degrees of trauma, and if the skin should break down the ulceration is extremely difficult to heal.

When the over-exposure has been severe, deep ulceration of the tissues may result. These ulcers are most intractable, may resist all form of treatment and may ultimately lead to the occurrence of malignant disease in the damaged area.

Late Reactions.—In rare cases the patient may exhibit no sign of over-exposure after irradiation, but may develop a peculiar condition a considerable time afterwards ; a bluish discoloration may appear below the skin, due apparently to some deeper damage, and gradually approach the surface when considerable sloughing of the tissues may occur.

The reason for these late reactions is not known, but they do not appear to be due to ordinary over-dosage, and there appears to be no means yet known of guarding against them.

VITRIOL THROWING

As a subdivision of homicidal burning, it is necessary to give some account of this crime, which still occurs occasionally.

Section 29 of the Offences against the Person Act, 1861, provides as follows :—

" *Whosoever shall unlawfully and maliciously . . . put or lay at any place, or cast or throw at or upon or otherwise apply to any person, any corrosive fluid or any destructive or explosive substance with intent . . . to burn, maim, disfigure, or disable any person, or to do some grievous bodily harm to any person, shall, whether any bodily injury be effected or not, be guilty of felony. . . .*"

The nature of the liquid thrown is merely defined, in general terms, to be " any corrosive fluid or any destructive substance "—a point which will require chemical evidence for its elucidation.

In common language, and according to the statute, the injury thus produced by a mineral acid such as oil of vitriol is called a burn ; but it is different in its origin, as well as in its progress.

The injuries from a corrosive fluid may be very severe, the severity depending partly on the nature of the fluid and partly on the time that it is in contact with the tissues. Great deformity from scarring has resulted, and of course if some of the fluid reaches the eye blindness may easily ensue.

The period at which a person may recover from an injury of this kind depends on the degree and extent of the injury and the part affected by the corrosive liquid. Although a person may not die from the direct effects of the acid, yet the inflammation or other complications which follow may prove fatal. In infants or delicate women, an extensive injury thus produced may readily destroy life. Sulphuric acid is most commonly used, but nitric and hydrochloric acid have also been thrown at the person with malicious intent. The caustic alkalies may also be used in these circumstances, as well as numerous other liquids, on which the only medical opinion required would be whether the article employed should or should not be considered as a corrosive liquid or a destructive substance. Unless vital reaction has taken place, there are no means of distinguishing the effects of a corrosive liquid on the living from those produced on the dead body. In either case a brownish, parchment-like condition will be produced by drying of the tissues underneath the epidermis.

To constitute a felony, it is not necessary that the *person* should have sustained any bodily injury from the act of throwing. On such occasions proof of the corrosive nature of the liquid is required, and this is easily obtained by a chemical examination of a part of the clothing. In *R.* v. *Goff*, the injury appears to have been of a superficial kind. The jury found the prisoner guilty of throwing the corrosive fluid, but with no intent to injure. This was tantamount to an acquittal. Damage to the clothing only does not constitute the crime. There must be an intent to injure the person.

When some corrosive has been thrown at a person and has reached either the skin or clothing, chemical evidence of the nature of the liquid thrown is of very great importance. The colour of the injured part may help. Thus sulphuric acid has a tendency to char tissues, and so may leave a dark or even black mark ; nitric acid produces yellow stains on the clothing, and hydrochloric stains it whitish or grey. On the clothing, nitric acid frequently makes a yellowish red stain, whereas sulphuric usually causes destruction of the material. Caustic alkalies produce a soapy feel on either skin or clothing. If enough of the fluid still remains on the skin or clothing to admit of extraction and analysis, such should be made (*vide* under "Poisoning"), but naturally this is rarely the case, as efforts are usually at once made to get rid of the fluid. It is very rare for the destroyed part of skin to be hard, as in a burn from flame ; it is usually soft and necrosed.

The mineral acids are sometimes used in other ways for the destruction of life.

A man poured a quantity of strong nitric acid into the ear of his wife while she was lying asleep. She awoke suddenly with a violent pain in the ear, which continued for three days, whereby she became weak and exhausted. Soon afterwards there was copious bleeding, and a portion of membrane was extruded. She lost the use of her right arm, and became completely deaf. Suppuration took place from the ear, and blood escaped daily. She gradually sank, and died six weeks after the injury, the right half of the body being convulsed before death. On inspection a portion of the external ear was wanting, and the ear-passage was much wider than natural. The brain near the petrous portion of the temporal bone was softened, and the bone itself diseased (carious). The injury had caused death indirectly by producing disease of the brain.[1]

In a case at Aberdeen, a woman poured oil of vitriol down the throat of her husband while he was asleep with his mouth open. She was convicted of murder. In *R.* v. *Lipski*,[2] a murder was committed by pouring a mixture of nitric and sulphuric acids down the throat of a woman in bed.

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[1] *Med. Gaz.*, vol. 17, p. 89.
[2] *C.C.C.*, July, 1889.

These, however, were treated as cases of poisoning, as death did not depend on the local or *external* mischief produced by the corrosive agent employed.

In March, 1904, a remarkable case of assault was heard by the Eastbourne magistrates. The complainant was Henry Andrews, and the defendant, Mrs. Pansy Pringle. It appeared that Andrews had complained of Mrs. Pringle to her husband. The parties met and discussed the matter. A lively altercation ensued, in which it was alleged that Mrs. Pringle attempted to stab Andrews in the face with a hatpin. Mrs. Pringle called Andrews a liar and a thief, and then suddenly threw the contents of a glass in his face, at the same time saying, " You will not see daylight again." Andrews' face began to blister, and he was unable to open his left eye, but under medical care he recovered. The stuff thrown in fact was a mixture of Condy's fluid and pepper. Mrs. Pringle said that her only object was to frighten Andrews. She was ordered to pay an inclusive penalty of £4 10*s*.

The material here used would certainly cause great suffering, and must be considered " noxious."

CHAPTER XIV

STARVATION

The subject will be briefly discussed under the following headings :-

Its Frequency as a Cause of Death—The Symptoms—The Treatment—The *Post-mortem* Appearances—Was Death due to Starvation ?—Medico-legal Aspects of Starvation—Baby Farming—Voluntary and Pretended Starvation.

ITS FREQUENCY AS A CAUSE OF DEATH

Taylor, in the previous editions of this work says : " Death from the mere privation of food is a rare event, although, if we were to form an opinion from the verdicts of coroners' juries, its occurrence would not appear to be uncommon in London and other large cities. Still it cannot be denied that starvation should be classed among the forms of violent death, sometimes the result of criminal neglect or inattention in the treatment of children or of infirm and decrepit persons, and thus constituting homicide ; or at other times, although rarely, arising from an obstinate determination to commit suicide in those from whom all other means of self-destruction are cut off."

These remarks may be considered as still applicable at the present day

SYMPTOMS OF STARVATION

The symptoms which attend on protracted lack of food (*chronic starvation*) are thus described : In the first instance, pain is felt in the stomach, which is relieved by pressure. The countenance becomes pale and cadaverous ; the eyes are wild and anxious in expression, the breath hot, the mouth dry and parched, the saliva thick and sparingly secreted ; an intolerable thirst supervenes, which in all cases of attempted suicide by starvation or privation of food from accident has formed the most prominent symptom. The body becomes slowly emaciated, the eyes and cheeks sink, and the prominences of the bones are perceptible ; the feeling of pain may be so intense as to give rise to delirium. There is the most complete prostration of strength, which renders a person incapable of the least exertion. Death may be preceded by delirium or convulsions.

Referring to cases which occurred during 1847, Donovan states that the persons who suffered from privation of food during the Irish famine of that year, described the pain of hunger as at first very acute, but after twenty-four hours had been passed without food, the pain subsided, and was succeeded by a feeling of weakness and sinking, experienced principally in the region of the stomach, accompanied with insatiable thirst, a strong desire for cold water, and a distressing feeling of coldness over the entire surface of the body. In a short time the face and limbs became frightfully emaciated; the eyes acquired a peculiarly wild stare; the skin exhaled an offensive smell, and was covered with a brownish filthy looking coating, almost as indelible as varnish. This he was at first inclined to regard as encrusted filth; but further experience convinced him that it was a secretion poured out from the surface of the body. The sufferer tottered in walking like a drunken man; his voice was weak, like that of a person affected with cholera; he whined like a child, and burst into tears on the slightest occasion. In respect to the mental faculties, the prostration kept pace with the general wreck of bodily power. In many there was a state of imbecility, in some almost complete idiocy; but in no instance was there delirium or mania.

In the last stage the body is reduced to an extreme state of emaciation, and before death it evolves an offensive odour, like that of incipient putrefaction. The excretions have also a putrescent odour. The surface of the skin may be covered with spots (petechiæ); and the person finally dies, in some cases slightly convulsed.

A healthy man, *æt.* 65, was by an accident shut up in a coal-mine for twenty-three days without food. When found he was conscious, and he recognised and named his deliverers. He was so weak that he could scarcely raise his hand to his mouth, and so much emaciated as to excite the surprise of his fellow-workmen by the extreme lightness of his body. Under careful treatment he so far recovered as to give an account of his feelings. For the first two days hunger had been his most urgent symptom. This passed off, and he then began to suffer from severe thirst, which he allayed by drinking some foul water. After ten days he became so weak that he was unable to move from the spot where he had laid down. He slept but little, and not soundly, never entirely losing the consciousness of his situation. His bowels acted only once, but he passed urine freely. The matter brought from his bowels by injections was dark-coloured, like meconium, and very fœted. He died on the third day after his removal, in spite of every effort to save him, and on the day of his death he was in the following state:—His features were sharp and pale, his eyes sunk; the skin of the abdomen seemed to touch the backbone, which could be distinctly felt through it; his body presented more emaciation than Sloan had ever seen produced by disease; he had altogether a dried appearance, like that of mummies found in catacombs; his pulse was gone; his voice was in a whisper, like the cholera voice; there was uneasiness, increased by pressure in the region of the stomach; his intellect was sound, and remained so until death.[1]

This case confirms the observation of Donovan that delirium is not a necessary attendant on protracted abstinence, and it proves that a person may die from the effects of abstinence or starvation in spite of the best directed efforts for his recovery. In the same journal are reported the cases of eight men and a boy who were shut up in a coal-mine for eight days without food[2]; but the symptoms here noted were rather those of hunger than of long abstinence. They all suffered from excessive thirst; they were all troubled with ocular illusions, showing cerebral excitement. According to Martyn, the emaciation in starvation is characteristic; it is a withering or shrivelling up of the skin, which has lost its elasticity, giving to youth the aspect of age. Death, when not hastened by disease, is slow and imperceptible, or it is precipitated by syncope from sudden effort, or by exposure to severe cold. Delirium is not, according to him, a symptom of starvation.[1]

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[1] *Med. Gaz.*, vol. 17, p 265.

[2] *Med. Gaz.*, vol. 17, p. 390.

The period which it requires for an individual to perish from hunger is subject to variation; it will depend materially upon the fact whether a person has had it in his power or not to take at intervals a portion of liquid to relieve the overpowering thirst which is commonly experienced. The smallest portion of liquid thus taken occasionally is found to be capable of prolonging life. It is probable that in a healthy person under perfect abstinence, death would not take place in a shorter period than a week or ten days. This opinion derives support from the results of those cases in which there has been abstinence owing to disease in the throat and difficulty of swallowing food. Age, sex, state of health, and the effects of exposure to cold may accelerate or retard a fatal termination.[2]

In a bombing attack on Clydebank on March 15th, 1941, two men were entombed for seven and a half days without food or drink in a cold, damp atmosphere. Both survived.

In death from starvation, as observed in hospital, there is commonly a subnormal temperature and a gradual numbing of the faculties, ending in a condition of coma from exhaustion.

Within very recent times, the famine in Bengal and the liberation of prisoners' camps in Germany,[3] Japan, and Malaya have made the clinical picture of starvation familiar to many observers. In general their descriptions agree with those recorded above. The extreme degree of emaciation and weakness found still compatible with life, has proved astonishing. A terminal. non-infective diarrhœa has been common, and a similar condition has resulted from injudicious feeding after liberation. Medical men, who were themselves interned, have expressed the conviction that the famine œdema due to hypoproteinæmia, occurs as a result of prolonged semi-starvation rather than in the course of what may be termed acute starvation. Where large numbers of starving or badly undernourished men have been aggregated in bad living conditions, superadded diseases have naturally been rife. Chief of these are typhus, tuberculosis, pneumonia, and intestinal infections.

TREATMENT

Rest, warmth, and a very gradual increase in the amount of food is the appropriate treatment. Even in cases of only moderate severity it is advisable to commence with small liquid feeds.

Loss of tissue protein is a serious factor in starvation, and, in particular, protein is required for the regeneration of the intestinal epithelium. From the start of treatment, therefore, a protein intake must be ensured, and this must be covered by sufficient glucose to prevent its being diverted for production of energy.

There has been a considerable amount of experimental administration to recent cases of protein hydrolysates with results that justify further consideration. Where large numbers have been involved, however, the practical difficulties have been great, and these difficulties are almost

[1] *Med Times and Gaz.*, 1861, 1, p. 344.
[2] 2 Casper, E. Tr., p. 28.
[3] Rosencher, H.: *B.M.J.* 2: 953, (1946).

equally applicable to the alternative use of serum and glucose saline intravenously. In practice, few, if any, patients suffering purely from starvation have been unable to swallow, though many have been too weak to drink unaided. The simplest form of initial feeding is, therefore, skimmed milk and glucose solutions by mouth, with a subsequent gradual progress up the dietetic ladder.

POST-MORTEM APPEARANCES

The body is shrunken and emaciated, and remarkable for its lightness. The skin is dry, shrivelled, and free from fat. The muscles are soft, deprived of fat, and much reduced in size. The stomach and intestines are usually found collapsed, contracted, and empty, the mucous membrane being thinned and sometimes ulcerated; the heart and kidneys free from any surrounding fat; the gall-bladder distended with bile; the omentum shrunken and destitute of fat. In one case the body was observed to be extremely emaciated; the intestines were collapsed; the stomach was distended with air, and slightly reddened at its greater extremity. The omentum had almost disappeared, and was entirely destitute of fat. The liver was small, and the gall-bladder distended with bile. The other viscera were in their normal state.

In some cases inspected during the Irish famine, Donovan states that the appearances which he witnessed were extreme emaciation, total absorption of the fatty matter beneath the skin of the body total disappearance of the omentum, and a peculiarly thin condition of the small intestines, which were so transparent that, if the deceased had taken any food immediately before death, the contents could be seen through the coats of the bowel. On one occasion he was able to recognise a portion of raw green cabbage in the duodenum of a man who had died of starvation. The thin condition of the coats of the intestines he looks upon as the strongest proof of starvation. This atrophied and thin state of the intestines is often found in the bodies of children who have died of summer "diarrhœa and vomiting." Death in such cases is no doubt partly due to starvation, or rather to loss of water.

These appearances, in order to throw any light upon the cause of death, should be accompanied by an otherwise healthy state of the body, since, as is well known, they may be produced by many organic diseases, and death may be thus due to disease, and not to the mere privation of food. It will not be always easy to say whether the emaciation depends on disease or want of food, unless we are put in possession of a complete history of the case. On this account, in all charges of homicidal starvation, the defence generally turns upon the co-existence of disease in the body, and the sufficiency of this to account for death.[1]

Stevenson believed that the only diagnostic signs of starvation were emaciation, absence of fat from the body, distension of the gall-bladder, and a peculiar thinning of the walls of the intestinal canal, which may become extremely translucent.

A full gall-bladder is, however, of frequent occurrence in death from many causes, and indicates nothing more than the non-passage of food over the orifice for some hours preceding death.

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[1] Cf. *R.* v. *Staunton and Rhodes.* (*infra*).

The following account of an autopsy, with the opinions expressed thereon, was furnished by Nelson Hardy, of Dulwich :—

" *Post-mortem made September 19th.*—Decomposition had considerably advanced. Body like skeleton with the skin stretched over it. Eyes sunken and cheeks hollow. Bones of face, limbs, and trunk project. Teeth in both upper and lower jaw, but not erupted. Length, twenty-six inches ; weight, eight pounds two ounces. Body much emaciated, not a particle of fat being found either under the skin or about the internal organs. The stomach and intestines were empty and contracted, no trace of food in them, and no disease found. The gall-bladder was distended with bile. The heart, lungs, and liver were healthy, but small. The bones of the skull had to be sawn through. The brain was apparently healthy, but weighed thirty-one ounces. Special search was made for any organic disease, such as tuberculosis, stricture of the œsophagus, or disease of the stomach or bowels, to account for the wasting, but none such was found.

" *Conclusions.* (1) The appearance of the body is that of a six or seven months old child, and the unerupted teeth would point to about the same age ; but in weakly children, dentition is sometimes delayed to eighteen months, or even longer. On the other hand, the length, twenty-six inches, the condition of the bones of the head, which at that age are usually soft enough to be cut through with a knife, and the full development of the brain, point to ten or twelve months as being the more likely age. (2) In the absence of diseases, gradual starvation must be looked upon as the cause of death. If water or milk and water in diminishing amounts had been given, this process might have extended over two months, or perhaps more.

" At the inquest a verdict was found of death from starvation."

WAS DEATH DUE TO STARVATION ?

If in an autopsy we find the appearances described above, and especially the absence of fat, we are justified in saying, in the absence of any disease, that death was at least accelerated, if not actually caused, by (*a*) an absence of sufficient food to maintain life, or (*b*) inability to utilise and absorb the food that had been given. If disease is found as well as these signs of starvation, the problem is more complicated, for it is only in certain special cases (stricture of œsophagus or pylorus, for example) that we are able positively to ascribe the wasting to the *mechanical* effects of disease. In the majority of cases it is impossible to disentangle the possible or probable *psysiological or pathological* effects of the disease from the effects of alleged starvation and neglect.

The difficulties connected with medical evidence of death from starvation were well illustrated in *R.* v. *Mitchell.*[1]

The accused was charged with the manslaughter of his servant, a woman, *æt.* 24, by withholding from her sufficient food. The evidence failed to support this charge, although there could be no doubt that deceased had died either from an insufficient supply of food or from the fact that the food which she had taken, or had it in her power to take, was not adequate to support life. A medical witness for the prosecution, who saw the deceased for the first time on January 4th, found the woman feeble, emaciated, and suffering from exhaustion ; she complained of great weakness and giddiness. There was no natural disease to which these symptoms could be referred. In spite of her removal and the use of stimulants, she died in five days. On inspection there were no appearances to account for death from natural causes. The body was much emaciated, and so light that it weighed only fifty pounds ; and there was no fat. The intestines were thin and transparent in parts ; the stomach and small intestines were much contracted. There was an entire absence of fat from the omentum and mesentery ; the gall-bladder was much distended with bile. The other organs of the body were healthy, and there was no disease in any part to account for the emaciation. Two other medical witnesses confirmed this evidence at the trial, and they all agreed that the appearances were consistent either with death from starvation or insufficiency of food or with the non-assimilation of food. It was suggested in defence that deceased might have died from chronic diarrhœa; but there was no proof that this had existed to a degree to account for death, and during the last five days of her life it was proved that she did not suffer from diarrhœa at all. A statement made by the deceased went to show that food had not been withheld from her, and the accused was acquitted.

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[1] Oxford Lent Ass., 1861.

The cause of death is, however, a separate question from the alleged criminality of the accused. On this point there is no reason to doubt that the opinion given by the three medical witnesses was perfectly correct, and justified by the facts which they had observed. The symptoms and appearances, as well as the entire absence of any natural disease to account for them, lead to the conclusion that the deceased could not have taken sufficient food to support life, or that that which she took was not properly assimilated; and in either case the symptoms and appearances would be those of death from protracted abstinence or starvation. As she was of weak constitution, and the weather at the time she was first seen had been remarkably cold, it is probable that these indirect causes aggravated in some degree the effects of insufficient nutriment. It was suggested that this could not have been a case of death from starvation, because, on the day before her death, the deceased became delirious; and delirium, it was alleged, is not a symptom of starvation. This may be true of some cases; but the occurrence of delirium in this instance was not sufficient to set aside the evidence furnished by the symptoms and the general condition of the body of deceased. Delirium may be the result of great bodily weakness, on whatever cause depending; it is probably more rare in cases of chronic diarrhœa than in those of protracted abstinence. Too much importance must not be attached to its presence or absence on these occasions, and it is going too far to assert that the occurrence of delirium before death would justify a medical witness in asserting that death could not have been caused by starvation when the condition of the body and the whole history of the case allowed of no other reasonable interpretation of the facts.

MEDICO-LEGAL ASPECTS OF STARVATION

Starvation is commonly the result of *accident* or *homicide*, but this is purely a question of fact, and can seldom be elucidated by medical evidence. The withholding of food from an infant forms a case of homicide by starvation, on which a medical opinion may be occasionally required. Such a case would now come under the Children and Young Persons Act, 1933, sec. 1, which is as follows :—

"(1) *If any person who has attained the age of sixteen years, and has the custody, charge, or care of any child or young person under that age, wilfully assaults, ill-treats, neglects, abandons, or exposes him, or causes or procures him to be assaulted, ill-treated, neglected, abandoned, or exposed, in a manner likely to cause him unnecessary suffering or injury to health (including injury to or loss of sight, or hearing, or limb, or organ of the body, and any mental derangement), that person shall be guilty of a misdemeanour, and shall be liable . . .*"

"(2) *For the purposes of this section a parent or other person legally liable to maintain a child or young person shall be deemed to have neglected him in a manner likely to cause injury to his health if he has failed to provide adequate food, clothing, medical aid, or lodging for him, or if, having been unable otherwise to provide such food, clothing, medical aid, or lodging, he has failed to take steps to procure it to be provided under the Acts relating to the relief of the poor.*"

This Act provides complete legal protection for children and young persons in such circumstances.

In *R.* v. *Staunton and Rhodes*, a man named Staunton, his mistress, Alice Rhodes, his brother, and his brother's wife, were tried and convicted of the murder of Harriet Staunton, the wife of the first-named prisoner.

Harriet Staunton was a woman, *æt.* 40-50, of weak intellect; her husband had formed a criminal connection with Alice Rhodes. The deceased and the prisoners all lived together in a small house in the country. She appears to have been submitted to a systematic course of cruelty and neglect; and as was alleged, this was carried to the extent of starving the woman to death.

The circumstances surrounding and the mode of her death, (coma, rigidity of one arm, and unequal pupils), giving rise to suspicion, an inquest was held, and an inspection made. The following is a summary of the appearances observed after death:—The body was emaciated and very dirty; lice and eggs of lice and bugs were in the hair; the skin, like parchment, was drawn tightly over the face; the breasts and the abdomen were shrunken. The brain was healthy, the exception of a small recent patch of tubercular deposit upon the arachnoid membrane of the upper part of the left hemisphere, two-thirds of an inch in diameter. There was *post-mortem* fullness of the vessels. There was no trace of meningitis, and the base of the brain was healthy. The heart was small in weight, empty, and healthy. The lungs were healthy, with the exception of about an inch and a half at the upper part of the left lung, which was the seat of inactive tubercular deposit. There was no disease or inflammation of the peritoneum. The omentum was scarcely visible. The gall-bladder was full. The stomach had some undigested food in it, consisting of milk and chopped or chewed eggs, which was distinctly visible through the thinned coats of the stomach. There was a patch of inflammation on the interior of the stomach on the lesser curvature. The intestines were collapsed, shrivelled, and completely empty. The rectum was congested. There was a total absence of fat from all parts of the body. All the organs were considerably below the normal weight. No poison was found in the body.

At the trial, positive statements were made that the cause of the woman's death was starvation. On the basis of these opinions, the judge summed up the case in a manner which led to a conviction. The case created great interest; and subsequently to the trial several eminent medical men came forward and gave emphatic expression to opinions that there was no medical proof that the death of the deceased had been caused by wilful starvation. The cross-examination of the medical witnesses for the prosecution elicited the fact that there were miliary tubercles in the brain. Indeed, there was sufficient evidence to show, in the opinion of the highest medical authorities, that the woman might have died from disease, and that, at all events, culpable neglect to provide the poor creature with such comforts as her condition demanded, might well have brought about her death. Alice Rhodes eventually received a free pardon, it being difficult to hold her legally responsible for the result; and the other three prisoners had their death sentence commuted.

In *R.* v. *Chattaway*,[1] a man and his wife were convicted of the manslaughter of their daughter, aged twenty-five. The cause of death was neglect and starvation.

BABY-FARMING

Under this heading may be described one of the most revolting crimes known to the law. In effect, it amounts to taking babies and young infants into a house for the ostensible purpose of nursing and bringing them up, and deliberately murdering them by starvation and neglect, and even by less doubtful means.

The following article from the *Lancet*, 1903, vol. 1, p. 251, is so true and such an excellent account of the terrible crime that it is inserted here nearly verbatim :—

> " Several recent criminal trials have drawn attention to the danger with which infant life is threatened by the practice of ' baby-farming,' but none since the case of the infamous Mrs. Dyer, who was hanged in 1896 after a series of cold-blooded murders, has thrown a more lurid light upon the details of this revolting traffic than the trial of the two women Sach and Walters, which was concluded at the Old Bailey on January 16th by the passing of the death sentence upon both the accused. It was shown for the prosecution in the course of the case, that the guilty women worked in connection with one another, being in constant communication and sharing the profits of their transactions, while the whole of the circumstances taken together proved beyond any reasonable doubt that each knew and connived at the acts of the other. Sach kept a maternity home,' including in her advertisement of it, the statement ' baby can remain.' Women—in every case probably women to whom motherhood meant ruin—came and were delivered at Sach's ' home.' Where their natural feelings for their offspring made them hesitate to dispose of the infants, Sach allayed any scruples that they might feel by specious assertions of her power to get the infants adopted into good homes in return for small payments. Immediately after birth, the children were taken from their mothers and handed to Walters, who removed them to her own lodgings. In the particular case of the murder upon which conviction has followed a few drops of chlorodyne deprived the newly born infant life, and the disposal of the body alone remained to be considered. Probably the method with which we are familiar from reading about it frequently in newspapers, was the one which Walters intended to employ. She meant to leave the infant's body in a parcel at a railway station or in a railway carriage ; but she had already excited the suspicion of a police officer who resided in the same house, with the result that she was arrested at South Kensington station with the corpse in her possession. The arrest of Walters was immediately followed by that of Sach, and the statements of the two women were such as to render it lawful for the prosecution to give evidence of other similar cases at the trial on an indictment dealing with the death of one child only, and the circumstance secured the just conviction of both the miserable wretches. When evidence was forthcoming that other children had been born under Sach's auspices and transferred to Walters, who had disposed of them in some way or other, of which no explanation was forthcoming, and when it was proved that one such child had been seen dead in Walters' arms in a coffee-shop, the possibility of the death which led to the arrest of the prisoners having been due to an accidental overdose of chlorodyne became too remote for acceptance. Similarly it became clear that Sach, though she did not herself kill the children, could not have been ignorant of their fate. It was left open to the accused to prove that they had in fact procured the adoption of infants by well-to-do people in accordance with their proposals to the mothers, but this they were unable to do. Upon proof of the clearest sort, both women were therefore found guilty of murder and justly condemned to death."

The difficulty in all cases where no poison can be found is to prove that starvation, and not disease, was the cause of death. The *post-*

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[1] (1922), 17, Cr. App. 7.

mortem appearances in starvation are not conclusive, and when to this is added the fact that many children fed on the best foods, and tended with the greatest care, often die from simple inability to utilise the food given, it is clear that medical evidence must be greatly reinforced by circumstantial and direct evidence before a conviction can be obtained.

Deliberate "baby-farming" was rendered much more difficult by the terms of the Children's Act of 1908, and the subsequent Acts amending or replacing it. These Acts set forth the conditions under which young children may be received and kept, and, largely as a result, the crime of baby-farming has virtually disappeared from the criminal calendar.

VOLUNTARY AND PRETENDED STARVATION

There are a few cases recorded in which persons have voluntarily abstained from food, liquid or solid, for the purpose of self-destruction. Suicide as a result of perfect abstinence is, however, rare; for the person cannot usually resist the intolerable thirst or the desire for food when placed within his reach. As it requires a period of at least eight or ten days for the destruction of life in these circumstances—*i.e.*, in the *acute* form of starvation—the resolution to abstain can rarely be maintained.

Pretended fasting has been a subject of imposture at various times. The case of Ann Moore, of Tetbury, is noticed by most medical jurists as showing how easily even the educated public may be deceived, and how lucrative such an imposture may become. An imposture of this kind can be detected only by the most minute observation. *R.* v. *Jacobs and wife* (the Welsh fasting girl), demonstrates that a watch fully and strictly kept may result in the detection of the imposture by the death of the performer.

This girl, *æt.* 13, is stated to have voluntarily abstained from any kind of food for a period of *two years*. She had kept her bed during that time, publicly exhibited by her parents as a girl of miraculous powers. Her lips were moistened with water once a fortnight, but, according to the parents, no food was taken. Four professional nurses were set to watch the girl, and the result was that, after passing through the usual stages of starvation, she died on the ninth day. She refused to take food at any time, and voluntarily accepted a lingering death rather than reveal the imposture. Her parents and those around her allowed her to die. An inquest was held, and a *post-mortem* examination gave the following appearances:—The body was plump and well formed; the membranes of the brain were much injected; the brain itself was healthy and of proper consistency. There was a layer of fat from half an inch to an inch thick beneath the skin of the chest and the abdomen. The contents of the chest were healthy. The stomach contained three teaspoonfuls of a semi-gelatinous substance, of the consistency of syrup, having a slightly acid reaction. The small intestines were empty, and presented no attenuation or thinning of the coats. In the colon and rectum there was half a pound of solid excrement in a hard state, which might have been there, according to the witness, a fortnight or longer. The liver was healthy, and the gall-bladder was greatly distended with bile; the kidneys and spleen were healthy, and the urinary bladder was empty.

The medical evidence at the inquest was to the effect that the child had died from exhaustion as the result of starvation, and the jury returned a verdict of death from starvation as a result of the criminal neglect of the parents in not administering food. They were tried on a charge of manslaughter. An attempt was made in the defence to refer death to shock, and not to the want of food. The medical facts relied upon in support of this theory were the presence of fat in the body and the absence of any thinning of the coats of the intestines; but, as was very properly pointed out, these conditions are only likely to be met with after long or chronic fasting, where the person has survived many weeks on insufficient or innutritious food. In the case of this girl, the only proved abstinence from food was during the last eight days of her life, and this period of time would not suffice for the entire removal of the fat and the thinning of the coats of the intestines. The prisoners were convicted of causing the death of their child by criminal negligence. The father was sentenced to twelve months', and the mother to six months', imprisonment.

In addressing the jury, the Judge said: "that although the unhappy victim herself might have been, and probably was, a consenting party to the fraud, yet parents were bound to supply the wants of their children of tender years; and if the prisoners, in order to avoid detection of the fraud which they had entered upon, had refused their daughter food, they were guilty of manslaughter. In this case the food necessary to support life was not supplied for a period of seven or eight days. If the jury came to the conclusion that the deceased died because she had had no food during those eight days, he presumed that they would also come to the conclusion that during the two preceding years she had been supplied with food."

This appeal to common sense should suffice to prevent a belief in any more "fasting" impostures, but has failed in its effect.

Dr. Tanner, an American physician, entered upon, and is stated successfully to have accomplished, a forty days' fast. It is doubtful whether this was a great imposture, or a remarkable feat of foolhardy endurance. The conditions under which he was watched were by no means satisfactory. Water was taken at times freely; and at one time it is said that he increased in weight upon a watery dietary.[1] No complete medical history of this case has been published.

During March to May, 1890, an Italian, named Succi, underwent a voluntary fast of forty days, apparently without permanent injurious effects. He had, however, free access to simple liquids, and also partook occasionally of a narcotic. At the termination of his fast, Succi gradually reverted to a solid dietary. His case merely proved that the body may be deprived of food for a considerable period, and yet remain fairly healthy; it added little or nothing, nevertheless, to our knowledge of fasting from a medico-legal point of view.[2]

George N. Robins contributes notes on a fifty days' fast, to which, were it not for the extraordinary length of time during which Alexandre Jacques succeeded in keeping body and soul together, on a diet of mineral water and a limited quantity of a secret powder, there would be no special interest attaching, most of the symptoms and changes observable being analogous to those recorded in the case of Succi's forty days' fast.[3] At the same time there are a few points of difference between the two cases which are worth noticing.

At the commencement, Jacques weighed 142 lb. 8 oz., and lost in all 28 lb. 4 oz., being a little over 19.8 per cent. of his original weight; whereas Succi's loss in forty days was 34 lb. 3 oz., or 26.75 per cent. The general shrinkage of the body was much the same as in Succi's case, with one remarkable difference. Whereas Succi diminished in height from 65¾ inches to 64½ inches, Jacques actually increased from 64½ inches to 65½ inches, the increase being almost uniformly one-eighth of an inch per week. This increase in height was very carefully noted and verified. The loss of weight was not regular. On a few occasions an increase was recorded, but was generally followed by a corresponding diminution the next

[1] *B.M.J.*, 1880, 2, p. 215.
[2] *Ibid.*, 1890, 1, 1444.
[3] *Ibid.*, 1890, 1, 1444.

day. These occasional increases were attributed either to a copious libation shortly before being weighed or else the non-emptying of the bladder for several hours. The total amount of fluid drunk was 1,784 fluid oz., an average of 35.4 oz. per day (half as much again as Succi took), the greatest quantity in one day being 66½ oz. He passed on the average about 20 oz. of urine, but on some days none at all. On the thirty-seventh day, Jacques suffered considerable pain from the presence of scybalous masses in the bowel, which were removed with some difficulty after repeated injections of hot water. The scybala weighed about three-quarters of a pound, and were of a very dark greenish brown colour. This was the first solid evacuation since the commencement of the fast. There were about 2 oz. of a clear watery evacuation on the twenty-fifth day. During the latter part of the time, Jacques suffered more or less from gout, which made its appearance first in the right hand, and subsequently in the other extremities. On one or two occasions he complained of headache, but not of a serious nature. As a rule he slept well, from midnight to 6 or 7 a.m.

During the fast he took small doses, repeated three or four times a day, of a powder made, he said, from the herbs which he collected in the fields and woods around Crayford, and it is to this powder that he attributed his capability of existing so long without food. He could not be persuaded to allow this powder to be seen by anyone ; therefore his statements with regard to it must be taken for what they are worth. The total quantity of powder consumed was 4 oz. As to his general condition, it was much the same as Succi's. His tongue was moist, and generally slightly furred. The heart-sounds were regular, and distinctly audible. The pulse varied from 60 to 114, according as he had been resting or moving about, a very little exercise sufficing to increase the rate. Temperature was high on one or two occasions, when the gout was rather severe, the highest being 100.2° F. on the forty-second day ; otherwise the variations from normal were insignificant, except on the thirteenth day, when it was as low as 97°. The respirations were generally about thirty per minute. The skin was dry, and comparatively inelastic throughout, and its sensitiveness was unimpaired. The muscular reflexes did not show any noticeable alteration. Hearing and sight were unaltered. Towards the last there was some unsteadiness in walking, but that was probably due more to the painful condition of the right knee and foot than to any actual exhaustion. On the last day his voice was much weaker than usual, and he complained of dryness of the fauces. During the fast, the excretion of urea diminished to a minimum of 114 grains per diem, the average for the whole period being 144 grains. His demeanour throughout the whole period of fifty days was very cheerful except when in pain from gout, but even then there was no marked irritability of temper. He smoked cigarettes continually except on one day (the forty-second), when he was advised to desist, the total number consumed by him during the fifty days amounting to nearly 700.

Having accomplished the full period of fifty days at 4 p.m. on September 19th, Jacques partook of some chicken broth, followed by a small piece of sole and a portion of mutton chop, washed down with Burgundy wine. This meal was digested without any inconvenience, and he afterwards resumed ordinary diet, being only careful as to the quantity taken at each meal.[1]

These records have a certain quasi-scientific interest, but require no further comment here.

In December, 1909, in *Leigh* v. *Gladstone*, *Green*, *and Helby*, it was decided that the forcible feeding of women suffragist prisoners who had "gone on hunger strike," was legal ; because, in the words of the Lord Chief Justice, the prisoners were "under the care of the Crown," which was bound to take reasonable and proper steps to prevent a prisoner from injuring himself or from taking his own life ; and, in the opinion of Dr. Helby, further abstinence from food would have been dangerous to the prisoner's life.

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[1] *B.M.J.*, 1891, 2. p. 710.

CHAPTER XV

ASPHYXIAL DEATHS

Definition of Asphyxia.
Symptoms and Post-mortem Appearances of Simple Asphyxia.
  Suffocation.
  Drowning.
  Strangulation.
  Hanging.

DEFINITION OF ASPHYXIA

By custom and general usage in medicine and physiology, the term asphyxia[1] is applied to a condition in which the supply of oxygen to the blood or to the tissues or to both has been reduced below the normal working level, and, in death from asphyxia, has been reduced below the minimum necessary for the continuation of life. It is seen frequently in disease, a point of some little importance in determining the cause of death in a case of doubtful significance. The relationship of oxygen and carbon dioxide to the cell is one of primary importance, and anything which interferes with the normal processes of oxidation and reduction is liable to cause damage to the cells which may be irreparable. The forms of violent death in which asphyxia is of special medico-legal interest comprise drowning, hanging, strangulation, and suffocation. Sometimes it is apparently the cause of death in bodies found in building or rooms that have been on fire (*vide* " Cause of Death in Burns "), and it is undoubtedly the cause of death in poisoning by CO and CO_2 and some other " gaseous poisons " (*q.v.*).

THE SYMPTOMS AND THE POST-MORTEM APPEARANCES OF SIMPLE ASPHYXIA

The changes likely to be produced by deprivation of oxygen will naturally vary with the length of time and the extent of the oxygen lack and the time elapsing before death takes place. The reserve of oxygen in the blood and tissues is small and will last only a few minutes.

Serious and irreversible effects occur if the deprivation of oxygen continues for more than about ten minutes—in fact, after such a period, death is almost certain to take place, whatever treatment is adopted.

In cases of obstruction of the respiratory passages, the effects of oxygen starvation are combined with the effect of increased carbon dioxide, and the following sequence of events is the result.

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[1] Etymologically asphyxia means pulselessness, and is therefore a particularly unfortunate word to have chosen, inasmuch as in death from asphyxia the pulse may continue to beat for from three or four, to as long as ten to twelve, minutes after respiratory movements have ceased.

The respiratory efforts are increased in number and amplitude, cyanosis develops, the pulse rate is accelerated and the blood pressure rises sharply. This phase is followed by a period of more intense cyanosis, expiratory convulsions, inco-ordinated movements of a convulsive nature, salivation and vomiting. The tongue may sometimes be bitten at this stage and urine and fæces may be voided. In the terminal stage the respiration is gasping, with periods in which no breathing can be observed. The pulse becomes irregular and feebler, the blood pressure falls, and death occurs with or without terminal convulsions.

The *post-mortem* appearances of asphyxia may be striking, *provided that the examination be held at once*, but with each hour's delay they become less and less marked. They are—

(1) **Externally** a good deal of lividity, especially about the edges of mucous membranes. The eyes are usually prominent; the tongue is in the majority of cases protruded between the teeth, and occasionally bitten owing to convulsive contraction of the jaws. *Rigor mortis* is slow of onset as a rule, and cooling of the body is delayed.

(2) **Internally,** the blood is found fluid for an unusually long time after death; it coagulates very slowly, owing amongst other factors to the excess of carbonic acid (CO_2) contained in it, and for the same reason is very dark in colour. The veins of the viscera in general are engorged with dark-coloured blood. If death has occurred slowly, the lungs are found intensely engorged; if death has occurred very rapidly, the lungs may be quite anæmic. The right side of the heart is engorged.

Oxygen starvation has a serious effect on parenchymatous cells, especially the cells of the brain, heart, and blood vessels.

In the brain, changes occur in the cells of the cortex and basal ganglia, and there may also be scattered hæmorrhages and œdema. Although there may be little damage observable in the heart, even microscopically, there is no doubt that failure of the heart is one of the causes of death in asphyxia, and may occur before complete asphyxia takes place. This heart failure may occur some days after severe anoxæmia.

Vascular injury is shown by the presence of hæmorrhages usually petechial, not only in the brain, but also in the pleura, pericardium, endocardium and heart muscle, and in mucous membranes.

A sample of blood from the left side of the heart, collected under oil, should be examined as soon as possible after death, and in cases of death from asphyxia, there should be a considerable or complete diminution in its content of oxygen. Less than one volume per cent. is likely to be found. (Moritz).

Marked hyperglycæmia may be observed in asphyxial deaths, and the finding of an increased percentage of glucose in the arterial blood in a case in which asphyxia is suspected goes far to confirm the diagnosis. According to Hill, glycolysis in *arterial* blood is complete in six hours after death in cases in which the blood sugar is presumably normal. He has also pointed out that the blood sugar on the *right* side of the heart tends to rise several hundred per cent. within a few hours of death owing to hepatic glycogenolysis. Blood for examination must therefore be taken from the left heart.

In death from acute coronary occlusion, increased intra-cranial pressure, and secondary shock, as well as anoxæmia from causes other than asphyxia, there may be a terminal hyperglycæmia.

SUFFOCATION—DEFINITION

By " suffocation " we are to understand that condition in which air is prevented from penetrating into the lungs, not by constriction of the windpipe, but by some mechanical cause operating (*a*) externally by pressure on the chest, or by blocking the mouth and nostrils ; or (*b*) internally by closing the lumen of the throat, windpipe, and air-passages. In this sense it will be perceived that drowning is merely one form of death by suffocation, the water being an effectual medium for preventing access of air to the lungs.

The term " suffocation " is applied to various conditions, in which the symptoms and effects differ. There may be a simple privation of air ; the air respired may not be renewed for the want of proper ventilation ; or the air which is breathed may be mixed with certain noxious gases or vapours, which by absorption into the blood through the air-cells of the lungs may destroy life. These will be found described under " Gaseous Poisons " (*vide* vol. 2). The symptoms preceding death, the disposition to recovery, and the *post-mortem* appearance in fatal cases, will differ in these circumstances. As regards simple asphyxia, the results of the experiments above described in reference to the duration of life under privation of air may be considered applicable to a human being ; and it may be fairly inferred that the life of a man would be destroyed in from four to five minutes after the power of breathing had been completely arrested. This must be considered only as an average in ordinary circumstances. Cases will be recorded below in which death seemed to be almost instantaneous when a foreign body blocked the windpipe, and under both " Hanging " and " Strangulation," we have referred to the extraordinarily rapid loss of consciousness in such cases.

Smothering is a variety of suffocation, and is caused by covering the mouth and nostrils in any way, so as to prevent the free ingress and egress of air. Like drowning, hanging, or strangulation, it produces death by asphyxia.

There are many different ways in which suffocation may be induced, including : 1. The close application of the hand over the mouth and nostrils, or the placing of a plaster or cloth over these parts, combined with pressure on the chest. This was formerly not an infrequent form of homicidal suffocation. 2. Smothering, or the covering of the head and face with articles of clothing, etc., by which breathing is effectually prevented. In this group must be included " overlaying " of infants. 3. The accidental or forcible introduction of foreign bodies into the mouth and throat. 4. The flow of blood, pus, etc., into the windpipe from a wound in the throat, or from the bursting of a blood vessel or aneurysmal sac. 5. In wounds of the throat, when the windpipe is completely divided, the lower end may be so drawn into the wound as to produce a closure of the orifice, and intercept the passage of air. One or other of these causes frequently operates to render a wound in the throat fatal. 6. The plunging of the face into mud, snow, dust, feathers, or similar substances. In all these cases death takes place from asphyxia, and with great rapidity if the chest sustains at the same time any degree of forcible compression. 7. Swelling or spasm of the glottis produced by toxins, corrosive substances or hot water.

Among many reported cases of death from suffocation produced by mechanical causes, the following are deserving of notice :—

1. A boy died in half an hour with alarming symptoms somewhat resembling those of poisoning, and it appeared that a simple medicinal powder had been given to him about five minutes before the attack. On inspection, the lower part of the windpipe was found blocked up with cheesy scrofulous matter : it was evident that the child had died from suffocation as a result of disease, and not from the medicine. 2. A child of eight years of age, while at play, was suddenly seized with symptoms as of a fit. He was quickly carried home, and became violently convulsed. Although retaining consciousness and speech, his countenance was extremely anxious, and he uttered the expression that he should die. In the hurry of the moment, there was no opportunity of getting any distinct knowledge of the previous history beyond the surmise that the boy had swallowed something. The windpipe was immediately opened, and a little air issued from the opening : artificial respiration was attempted, but without effect, as the child gave but two gasps after the operation, and died. An inspection revealed the presence of a foreign body in the upper part of the air-passages. The substance was whitish, and covered with mucus : on examination it was found to be a bronchial gland. Upon opening the windpipe, the spot whence the gland had issued was perceived. 3. A man, *æt.* 31, was put to bed drunk, having previously vomited ; and shortly afterwards he was found dead. In the upper opening of the windpipe (rima glottidis) was a thin and transparent piece of *potato-skin* so closely applied to the fissure as to prevent breathing. The man had died, accidentally suffocated from this mechanical cause. He had had potatoes for dinner the day before ; the piece of skin had probably been thrown up at the time of vomiting, and had been drawn back by inspiration into the position in which it was found. Owing to intoxication, the deceased was unable to cough it up.

SYMPTOMS OF SUFFOCATION

These are sufficiently described under asphyxia in general.

CAUSE OF DEATH IN SUFFOCATION

It has already been stated that death takes place by asphyxia ; and this occurs with a rapidity proportional, to some extent, but not always to the degree of impediment existing to the passage of the air. There does not seem to be any reason to attribute death to apoplexy. The congestion of the cerebral vessels may be regarded as a consequence of the disturbance of the functions of the lungs. If the veins of the neck were opened, so as to prevent an accumulation of blood in the vessels of the brain, it is certain that the prevention of respiration would cause death ; therefore we may regard death from suffocation as resulting from pure asphyxia.

TREATMENT OF SUFFOCATION

In *treating* cases of suffocation we have simply to allow of the renewal of air by removing the obstacle to respiration if this be possible. The results of experiments on dogs show that, even with complete closure of the windpipe, an animal may recover spontaneously after nearly *four minutes'* deprivation of air ; and there is every reason to believe that a human being might recover after the same length of time. If five minutes have elapsed, there will be but little hope of recovery. If efforts at respiration are not made spontaneously on the removal of the obstruction, artificial respiration must be adopted. In some cases, tracheotomy may be necessary.

In hanging and in strangulation there is sometimes great violence done to the parts about the neck. In suffocation these accidental obstacles to recovery do not exist. All experiments go to show that, even in the form of asphyxia which is most favourable for recovery, the complete suspension of respiration for *five minutes* is fatal.

POST-MORTEM APPEARANCES IN SUFFOCATION

These will be described as follows :—

General external appearances.
General internal appearances.
Special observation of the air passages, mouth, etc.

General External Appearances. There are rarely any considerable marks of violence externally. When the body has become cold, there may be patches of lividity diffused over the skin ; but these are not always present. In a set of cases examined by Tardieu, the skin of the face, neck, and shoulders presented dotted or punctiform ecchymoses.[1] The lips are livid ; the skin of the face and neck may be pale, or present a dusky-violet tint ; the eyes are congested ; and there is a mucous froth about the lips and mouth.

None of these signs are at all characteristic, and their absence is no proof that death did not occur from suffocation ; if they are present, they certainly offer grounds for preliminary suspicion, and give a hint to the pathologist to be especially careful in examining the air-passages ; they are all of them the more likely to be found the sooner the body is viewed after death. The mouth or nostrils may be found filled with some foreign material that has caused death, and in accidents the face and body or clothes may be covered with the same material, dust, mud, etc.

General Internal Appearances. The *lungs*. These are usually deeply congested, and in general terms, one may say that the slower death has been, the more intense is the congestion observed. There is redness of the larynx and trachea, and commonly spots of ecchymosis. The presence of the asphyxiating agent may be observed. Tardieu first noted that the *lungs* present a special character, consisting of the presence of small ecchymosed spots or patches beneath the pleura or investing membrane (punctiform or subpleural ecchymosis). He described these spots as of a dark colour, and varying in size from a pin's head to a lentil. In the adult they are of still larger size. Their number is variable ; sometimes five or six may be found, at others twenty or thirty : and in other cases the surface of the lung may be so studded with them as to give to it a granite-like appearance. These spots of ecchymosis are sometimes agglomerated, at other times separated, but their outline is generally distinct and well defined on the surface of the lungs. They are most frequently seen at the root, at the base, and about the lower margin of the lungs. They are due to small effusions of blood from ruptured vessels. They may be distinguished so long as the tissue of the lung remains unchanged. A similar appearance is also presented by the pericardium. Tardieu states that he has seen this subpleural ecchymosis in the body of an infant, ten months after death. He admits, however, that this condition may also be found in the bodies of children that have not breathed after birth: hence no inference of death from suffocation should be drawn from this appearance in the lungs of children, unless they have actually received air. In three instances he met with this appearance in lungs which sank in water, and had all the usual characters of these organs in a fœtal state. The children had been born living, prematurely, and in conditions in which life could not be perfectly established by respiration: one of them had made several cries without effectually receiving air into the lungs. This struggle to breathe produces an appearance resembling the effect of suffocation. In new-born children that have died from suffocation, the thymus gland has been found in a similar condition. The same state is brought about by pressure on the umbilical cord before respiration takes place; and hence is not infrequently noticed in the cases of still-born children, when the cord has been for some time prolapsed during the act of parturition.

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[1] "Ann. d'Hyg.," 1866, 2, 346.

The dotted appearance of the surface of the lungs in suffocation, when it exists, is not attended with the apoplectic effusions in their substance which have been met with in death from strangulation. Emphysema or escape of air from rupture of the air-cells is occasionally observed. The more rapidly suffocation has taken place, the more strongly marked is this appearance of the ecchymosed spots. On the other hand, when the interruption of breathing has been slow and gradual, the substance of the lungs is more congested with blood, and then these dots or patches are merged in the general violet colour of the surface of the organs. The lining-membrane of the windpipe and larger air-tubes is sometimes pale, but more commonly, when the lungs are much congested, reddened or dark-coloured. In the air-passages there is occasionally a frothy, reddish-coloured liquid.

These subserous and other ecchymoses are seen in death from causes other than asphyxia, and are frequently absent in asphyxial deaths in adults. Their presence, therefore, suggests some form of asphyxial death, but their absence cannot be used as any strong argument against such a form of death.

Foreign Liquids or Dust, etc., in the Air-tubes. The air-tubes should be cut open as far as a fine blunt-pointed pair of scissors will allow, and material of this sort looked for. Any peculiar smell should be observed when opening the lungs.

A healthy adult at work as a compositor, one hot summer's day, in an upper room of a printing establishment, felt thirsty, ran downstairs to a neighbouring public-house, and ran back again to his work. He reached the door of his workroom, and fell down dead: at the autopsy, on squeezing the lungs, a dirty brown fluid was observed to pour out in some quantity, which, from its colour and smell, was found to be beer, or at least a large admixture of that beverage. This point at once cleared up the matter, and showed that the man had vomited and aspirated beer, which had caused his death by suffocation.

The *heart* presents no special appearance indicative of the mode of death, if we except the presence of small spots of ecchymosis found below the investing membrane, like those met with on the lungs. They have been found near the roots or origin of the great vessels, and on the heart, but are not so frequently observed in this organ as in the lungs. The blood is generally dark-coloured and liquid. It does not readily coagulate. Thus it happens that any wounds made after death in the bodies of persons suffocated, bleed more and for a longer time than in other cases.

The *stomach* and *intestines* have been observed to present patches of lividity. The kidneys, liver and spleen are congested with blood, and shew the presence of ecchymosis.

The vessels of the *brain* are sometimes congested, but at other times they do not appear to be more than ordinarily full. Their condition may be affected by the congested state of the lungs, as well as by the slowness or rapidity with which death takes place. Punctiform ecchymoses are sometimes observed on meninges and on the surface of the brain. Again, it must be repeated that none of these features is constant or characteristic, and in a large proportion of cases there is nothing to suggest the cause of death.

WAS DEATH DUE TO SUFFOCATION ?

The inspection of the body of a person suffocated presents so little that is peculiar that a medical man, unless his suspicions have been roused by circumstantial evidence, or by the discovery of foreign substances in the air-passages, would probably pass it over as a case of death without any assignable cause—in other words, from *natural causes.* The punctiform ecchymoses on the lungs and heart, described by Tardieu, cannot be treated as absolute indications of this mode of death. In examining the body of the woman Campbell, who was suffocated by Burke in Edinburgh (1829), Christison was unable to come to a conclusion respecting the cause of death until some light had been thrown on the case by collateral evidence. The organs within the chest were perfectly natural, the lungs remarkably so, and unusually free from infiltration. The blood in the heart and great vessels as well as throughout the body was fluid and black.[1] On this occasion a violent death was suspected, because there were marks of violence externally, and the face of the deceased presented some of the characters of strangulation. These conditions, however, are by no means essential to death from suffocation, and when they exist they can only be regarded as purely fortuitous accompaniments. Appearances similar to those found in the bodies of suffocated persons, even the dotted ecchymoses on the lungs, are frequently met with in inspections when death has taken place as a consequence of disease or accident. They can, therefore, furnish no conclusive evidence of the kind of death ; and they scarcely permit a witness to establish a presumption on the subject until, by a careful examination of the body, he has ascertained that there is no other cause of death depending on organic disease or on violence. Medical evidence may, however, be serviceable in some instances. Thus the witness may have it in his power to state that the appearances in the body are consistent with this kind of death ; that the body is in all respects healthy and sound, and that death was probably sudden—as where, for instance, undigested food is discovered in the stomach. The presence of ecchymoses on the surface of the lungs may justify a strong opinion of death by suffocation when no other cause is discoverable.

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[1] *Edin. Med. and Surg. Jour.*, vol. 31, p. 239.

These difficulties become even more apparent in the case of children alleged to be overlaid or smothered by accident in bed (*vide* below).

It is desirable, in reference to future cases, to point out the fallacy involved in the assumption that congestion of the lungs is necessarily present in this kind of violent death. Watson observes that the engorged state of the right side of the heart and lungs is greatest when the act of suffocation (asphyxia) has been slow and gradual, by the access of air to the lungs not having been completely prevented. When, on the other hand, death has taken place quickly and suddenly from this cause, there is little or no unusual congestion of blood in the lungs or heart.

In reference to the case of Campbell, Christison observed, "that the conviction in the public mind that a well-informed medical man should always be able to detect death by suffocation simply by an inspection of the body and without a knowledge of collateral circumstances is erroneous, and may have the pernicious tendency of throwing inspectors off their guard, by leading them to expect strongly-marked appearances in every case of death from suffocation. That such appearances are not always present ought to be understood by every medical man who is required to inspect a body and give an opinion of the cause of death." At the same time, in the absence of marked appearances to indicate violent death, due caution should be used by a medical witness in expressing an opinion. At the trial of the prisoner Burke, Christison restricted his opinion by stating that death by violence was, from the medical circumstances alone, *very probable*—a degree of caution which on similar occasions it is desirable for a medical witness to imitate.

The medical witness should look for the special indications in the lungs of suffocation, the circumstances in which the body or bodies are found, the evidence of sudden death in the presence of food in the stomach, and, lastly, the absence of any other cause to account for death. All these sources of evidence may fail; and a medical opinion on the case may become little more than a conjecture. Still this may suffice when the evidence from extraneous circumstances is strong.

WAS IT ACCIDENT, SUICIDE OR HOMICIDE ?

We may consider the evidence as follows :—

1. Statistics.
2. Age and condition of the victim.
3. Signs of violence.
4. Nature of substance causing death.
5. Position of the body.
6. Circumstantial evidence.

1. **Statistics.** In the Report of the Registrar-General for England and Wales for the year 1940 it is stated that 1,327 children under one year of age died from asphyxia during or after birth.

The Children and Young Persons Act, 1933, section 1, provides as follows :—

"*Where it is proved that the death of an infant under three years of age was caused by suffocation (not being suffocation caused by disease or* *the presence of any foreign body in the throat or air-passages of the infant) whilst the infant was in bed with some other person over sixteen years of age, and that that other person was at the time of going to bed under the influence of drink, that other person shall be deemed to have neglected the infant in a manner likely to cause injury to its health.*"

2. **Age and condition of Victim.** Homicide by suffocation is not very common, except in infants, although it is a ready means of committing murder. Hitherto the cases which have come before British courts of law have been those either of infants, of the aged and infirm, or of persons enfeebled by illness.

Homicide by suffocation is not likely to be attempted on a healthy adult person, unless he is rendered defenceless by intoxication.

As an accident, smothering may conceivably take place when a person falls, in a state of intoxication and debility, so that his mouth becomes covered, or the access of air to the mouth or nostrils is interrupted. The power of aspiration in the chest is exceedingly great, and a person may, by falling into the midst of dust, ashes, or other substances, draw a portion of these substances into the air-passages, and thus die by suffocation.

The suffocation of new-born children by the introduction of substances into the mouth is not infrequent. The unnecessary force employed generally leaves traces of violence, which may be easily discovered by a careful examination, even should it happen that the substance used for the homicidal purpose has been removed. An objection has been suggested to evidence founded on a fact of this nature, *viz.*, that the substance might have been introduced soon after death, in order to create a suspicion of infanticide against the mother ; but such an objection could hardly be received, and the fact would be only one out of many brought against an accused person. According to Devergie, the appearances produced by the introduction of a plug of linen into the mouth *during life* would be these : The mouth contracting posteriorly, the pressure would be greater in this situation ; consequently the blood would be forced out of the compressed mucous membrane of the palate. In the fore part the pressure would be less ; and here the blood would accumulate, so that the mucuous membrane in this situation would become swollen and darkly congested. In trusting to these characters, it must be remembered that similar appearances would probably result if the plug were introduced immediately *after death*, as also that, even introduced during life, the characters might be lost if the plug were removed from the mouth before the body had entirely cooled.

It will be noticed that in such incapacitated, and young or old people, circumstantial evidence must be relied upon almost entirely.

3. **Signs of Violence.** If the person has been able to struggle, it is probable that marks of violence, in the shape of scratches or bruises, may be found about the mouth and nostrils, with bruises or marks of pressure on the chest, legs or arms, and a bloody mucous froth in the air-passages. The marks of violence may be slight, or even entirely absent ; and, unless the assailant has employed an unnecessary degree of violence, it is probable that the crime may pass altogether unsuspected (*vide* case, p. 532). It is certain that most individuals would have it in their power,

unless greatly incapacitated by disease or intoxication, to offer such a degree of resistance as would leave upon their bodies indubitable evidence of murderous violence. Death by suffocation may be considered as presumptive of homicide, unless the facts are clearly referable to accident. Accidental suffocation is, however, so obvious from the position of the body and other circumstances, that when death is clearly traced to this cause, it is not easy to conceive a case in which it would be difficult to distinguish it from one of murder.

In the case mentioned below in which food was found in the air-passages, and in which there were signs of trampling on the body, the violence clearly established homicide.

4. **Nature of Substance causing Death.** Those instances of accidental suffocation that depend on disease or on the impaction of food, either naturally introduced into the mouth or by aspiration on vomiting, are easily detected by an examination of the body ; generally speaking, they present no difficulty, provided that there is no violence, and circumstantial evidence is present. In some instances the very means that have been adopted to produce suffocation may forbid the supposition of accident, and clearly establish the fact of homicide. One case is elsewhere reported in which a plug of dough had been forced into the larynx, and had caused death.

In fact, if the foreign substance is not food nor the material in which the face of the body is found, homicide will be strongly suggested, and especially so if it be not some natural object which a child could have obtained.

In the case in which a cork was found in the air passages as mentioned below, the material strongly suggested homicide. Devergie mentions the case of a man who fell asleep near some sheaves of corn. He was found dead with signs of asphyxia and an ear of corn was found fixed in the air-passages.

5. **Position of the Body.** The following questions may arise here :—Was the position such as to be explicable on the supposition of accident ? Was it in such a position as might have been brought about by a murderer? Could not the deceased have had strength or presence of mind to escape ? Could he have been actually suffocated in the position in which his body was discovered ? A little reflection upon the circumstances—for here something more than *medical* facts will be required—may enable a witness to give satisfactory answers to these questions.

If the body has been shifted, drawings or photographs of the attitude in which it was found are very desirable, and even necessary, if criminal proceedings are liable to follow.

6. **Circumstantial Evidence.** This must play a leading part in determining the point we are now discussing. We have seen that the signs of suffocation may be absent, so that only circumstantial evidence, even of the mode of death, may be present, quite apart from *how* it came about. Moreover, the points we have noticed in detail must be looked upon as in great measure circumstantial. In babies and young children, discoverable motives for homicide will often form important links in the chain.

We may now give brief details of a few cases, first of **accidental choking** :—

A child seventeen months old died suddenly during a violent fit of coughing. A full-grown pea was found firmly fixed in the larynx, between the cricoid and thyroid cartilages, blocking up the air-passages. It was probable that it had been in the air-tubes some time, as there was muco-purulent matter effused, and under a sudden fit of coughing it had been thrown into the position in which it was found, thereby causing death by suffocation.

In 1898, a small child who was suffering from laryngeal obstruction, that had come on after taking some soup, was admitted to the London Hospital. Nothing could be seen, and the child died two days later, when a small rough piece of bone was found in the larynx ; it had caused death by suffocation. In 1900, a man was found dead on the foreshore of the Thames. On autopsy it was found that death had taken place from aspiration of vomited particles of food (fish and vegetables).

Accidental suffocation from the impaction of large masses of food is by no means uncommon. If the glottis (the opening of the wind-pipe) be completely closed by food, death may take place suddenly. It does not follow, however, that a person so situated is incapable of making some exertion or of moving from the spot.

A man was suddenly choked by swallowing a large piece of meat ; he immediately walked across the street to a chemist's shop, and soon after entering it, he fell down in a state of insensibility. After death the throat was found to be filled with a piece of beef, which rested on the glottis, and had pressed the epiglottis forward. Part of the mass had entered the windpipe through the rima glottidis, and had thus caused death by suffocation.

It is probable that, in this and similar cases, the foreign body does not so completely close the aperture as to prevent some degree of inspiration, but the blood being imperfectly aerated, asphyxia is speedily induced.

A youth, *æt.* 17, lost his life owing to an oyster becoming impacted in the air-passages during the act of swallowing. In another, death was caused by a piece of potato which was found fixed in the trachea.

A person has been charged with causing the death of another when the cause of death was really due to an accidental impaction of food in the larynx. An instance of this kind is reported in the *Lancet*, 1850, 1, p. 313.

The deceased had had a quarrel with the accused, and they were seen to fall to the ground together, while struggling and fighting. About two hours afterwards, the deceased, who appeared quite well, was observed to rise from the dinner-table and leave the room. He was found leaning against the cottage, and he expired in two or three minutes. The man with whom he had been fighting was charged with manslaughter. At the inquest the medical witness stated that he found the organs of the body, excepting the brain, in a very healthy state. The brain was excessively congested, and he attributed death to apoplexy. The coroner desired the witness to examine the mouth and throat (which he had omitted to do at the inspection), as, from the suddenness of death after eating, he (the coroner), thought the man might have choked. This opinion turned out to be correct. A large piece of meat was found wedged in the opening of the throat ; this had caused death by suffocation. It had not completely closed the air-passages in the first instance ; hence the man was able to move from the dinner-table. Lewin describes a case in which a soldier was found dead in his cell two hours after his incarceration. On inspection, it was found that a large piece of potato was impacted in the air-passages, and had completely prevented respiration.

A man, *æt.* 57, while lunching, fell forward in his chair and died. At the *post-mortem* examination a piece of chicken weighing an ounce was found wedged in the air-passage.

A child was found dead in a room, with its face in the ashes under a grate; it had fallen during the absence of the mother, and, from its helpless condition, had speedily become suffocated. Some of the ashes were found in the windpipe

In some instances a retraction of the base of the tongue may lead to the suffocation of a new-born child.

In new-born infants smothering is not an unusual occurrence, sometimes originating in accident, and at others in criminal design. An infant may be speedily killed by smothering. If the mouth is covered with clothing, or slightly compressed (so that respiration is interrupted) as in the act of carrying a child in the arms, this will suffice to cause death, and death may take place without being preceded by convulsions or other striking symptoms.

In a case which occurred at Ayr, a woman was charged with the murder of her child by smothering it in her shawl. She was travelling on a steamboat; it was a cold and stormy day, and she had wrapped the shawl closely round the head of the child. In another case, a perfectly healthy child, about three months old, was found dead in bed. It had been left by the nurse in bed quite well in the morning when she got up. A quarter of an hour afterwards the father went into the room and could not see the child; but on removing the bed-clothes, he found it beneath them, quite dead, its head completely covered by six folds of clothes. The body was quite warm, the countenance calm, and the limbs relaxed: there was a little frothy mucus about the mouth, but nothing to indicate a violent death. There was no doubt, from the circumstances, that the child had been accidentally smothered or suffocated; its body had slipped down beneath the clothes, the mouth and nostrils were covered, asphyxia speedily ensued, and this proved fatal owing to the helplessness of the child.

Infants are frequently found dead owing to their being suckled at night while the mother is in bed. The child's face is pressed on the breast; mother and child fall fast asleep; the head slips beneath the clothes, and the child is then quietly suffocated. There may be no mark of pressure on the body. A child, five days old, died quietly on its mother's arm while lying in bed. There was much lividity about the head, neck, and back; but there were no marks of violence. The bronchial tubes of the right lung contained bright florid blood. The left lung was engorged with blood, but there was no effusion. The heart was firmly contracted, and there was only a small quantity of blood in its right cavities.

A groom was found dead, with his head downward, in the iron rack used for feeding horses with hay. His legs projected from the hole in the floor above. The space was so narrow that there had been no room to turn, and there was no fulcrum by which the deceased, who had thus fallen head downwards into the hole, could again raise himself. There was no doubt that, in reaching into the hole, the deceased had accidentally fallen head foremost into the rack in the midst of the hay; and he had died in this position, without the power to raise an alarm or to make any successful effort for his extrication.

It is possible that homicide might be committed in this manner; but there was no reason to suspect it in this instance. Singular accidents may lead to death by suffocation, in cases in which, unless the collateral circumstances were known, homicide might be inferred.

A man was engaged in shooting flour from the upper to the lower part of a granary; he fell through the trap-door, and a large quantity of flour fell with him and covered him. Nothing was known of the accident until his dead body was taken out below; it was then found that his mouth and nostrils were completely filled with flour, and that he had been suffocated. A policeman running along a road with two companions suddenly stumbled, and fell forwards, with his head in the road and his feet and legs on the pathway. As he did not rise his companions went to his assistance and found him insensible. He was taken to St. George's Hospital, and he was then pronounced to be dead. On inspection it was found that the glottis (windpipe) was obstructed by three false teeth, which had been only lately put in: this obstruction had led to suffocation and death. Other cases are recorded in which suffocation had been caused by false teeth becoming displaced and falling back into the throat during sleep, in persons who had worn them during the night. In 1859, Dr. Stevenson rescued a woman from imminent suffocation by the prompt removal of a set of artificial teeth from the throat in these circumstances.

Infants often lose their lives by accidental suffocation in consequence of the reprehensible habit followed by nurses of stuffing into the mouth a little bag filled with sugar or other sweet material, in order to quiet the child. The bag is liable to be drawn by suction to the back of the mouth, and mechanically to shut off the air-passages. The detection of this dangerous practice can only be a matter of pure accident; hence a fatal case can be rarely the subject of a coroner's inquest, and even then medical evidence may fail to throw any light upon the cause of death. In one instance it gave rise to a criminal charge.

R. v. *Cox.* A mother was tried for the attempt to suffocate her infant, eleven days old. The child was discovered by another person with a piece of rag hanging from its mouth. It was livid in the face, but when the rag was removed, it made a violent gasp, and recovered its breath. There was no malice on the part of the accused, and she was acquitted.

Of **suicidal suffocation** the following are examples:—

A woman locked herself in her room with her young child, placed herself under the bed-clothes, and desired the child to pile the several articles of furniture in the room upon the bed. When the apartment was entered, some hours afterwards, the woman was found dead; she had evidently been suffocated. Had not the child clearly detailed the circumstances, a suspicion of murder would have arisen. A woman is reported to have committed suicide by leaning with her mouth against the bed-clothes; she died from suffocation.[1]

In the case of a body found with a plaster covering the mouth and nostrils, or the traces thereof, a medical witness might be asked, whether the plaster could have been so placed by the deceased himself.

Some singular cases are on record, in which persons have committed suicide by blocking up the throat mechanically

An instance of this form of suicide is reported in the *Edin. Med. and Surg. Jour.*, vol. 56, p. 391.[2] A woman confined in prison, forced a plug, three and a half inches long, consisting of pieces of blanket tightly rolled, into the back of her throat. A medical certificate was given that the deceased had died of apoplexy. The body was sent to one of the anatomical schools, and on reinspection, it was accidentally found that the throat was firmly blocked. At an inquest it appeared that the deceased had thrust into her throat a large piece of rag, which had been used in applying a lotion. She speedily died from suffocation, and after death the rag was found lodged at the back part of the throat.

A man confined as a prisoner in a cell committed suicide by suffocation. He was found lying on his face, dead. He had thrown his bed on the floor, filled his nostrils with pieces of rag, his mouth with a handkerchief, and had tied another handkerchief over his mouth, after which he must have thrown himself upon his face.

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[1] Another case of suicidal smothering of this nature is reported in the *Annales de Médicine Légale*, May, 1927.

[2] Littlejohn's "Forensic Medicine," 1925, fig. 70, gives an illustration of this case.

Some of these cases are likely to be mistaken for apoplexy, and they show the necessity for a careful examination of the mouth and air-passages in every instance of sudden death.

Several cases have occurred in which insane persons have committed suicide by tearing up articles of clothing or bedding, rolling up a shred into a conical plug, and inserting this into the back of the pharynx.

Cases of Homicidal Suffocation. Targett brought the following curious case before the Medico-legal Society :—

A child of thirteen months of age was brought into Guy's Hospital with symptoms of laryngeal trouble ; it died in a short time. Targett performed the autopsy, and found in the stomach two corks of the size to fit an ordinary medicine bottle, and in the pharyngo-laryngeal space a much larger one firmly fixed, causing mechanical obstruction as well as inflammatory œdema. At the inquest, false evidence was given, which enabled an open verdict to be returned. Ten years later, in consequence of anonymous letters, the case was reopened in a trial at the Central Criminal Court, when the following evidence was given. The baby, a boy of four, and a man (the man and his presumed wife had taken the baby to lodge for payment) had been left for two hours alone in the room; on the woman's return, the child presented the symptoms for which it was admitted to Guy's Hospital. Targett repeated the evidence which he had given ten years previously, and stated that in his opinion it was impossible by accident for the larger cork at any rate to have reached and become fixed in the position in which he found it.

Circumstantial evidence showed that the accused could have obtained the cork. He was convicted of manslaughter and sentenced to seven years' penal servitude. Presumably the absence of motive and of deliberate intent to kill reduced the crime from murder to manslaughter, but of the homicide there could be no reasonable doubt.

A somewhat similar case has been reported by Littlejohn[1] :—

In the body of a woman, who, it was stated, had died suddenly, a quart-bottle cork was found inserted tightly into the upper part of the larynx. The sealed end was uppermost, and was roughened by the passage of the corkscrew. Moreover, fractures of the ribs were found, and it was clear that the deceased had not died a natural death.

It was suggested that the deceased, while extracting the cork from the bottle with her teeth, might, by the sudden impetus of the contained fluids, have drawn it into the position in which it was found. But this theory was negatived by the sealed end of the cork being found uppermost in her throat, as well as by the structure of the parts. The medical opinion was that the cork must have been forcibly placed there by another person, while the woman was in a helpless state of intoxication. There was no reason to doubt that this was a deliberate act of murder. Five persons were present with the deceased at the time of her death, but it was impossible to fix with certainty upon the person who had committed the act ; and the man on whom the strongest suspicion fell was acquitted on a verdict of "Not proven."

In *R.* v. *Spaul*, a man was charged with causing the death of a child by administering to it a large quantity of pepper in powder. From the medical evidence it appeared that death had been caused by suffocation, as the air-passages were choked up with pepper. The accused had used a pepper-castor, and the top came off, so that about half an ounce of pepper had found its way into the throat and air-passages of the child. He was convicted of manslaughter.

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[1] "Forensic Medicine," 1925, p. 110.

Death by suffocation, as a result of violence to the abdomen, is probably more frequent than is commonly supposed. It is likely to occur in the maltreatment of drunken persons, and during the commission of rape. Behrand reported a case of this kind, with a full account of the *post-mortem* appearances, in which suffocation was caused by the aspiration of food.

Devergie reported a case, in which a man was suffocated by having his face forcibly thrust into a heap of corn. A quantity of the corn was found blocking up the mouth and nostrils, and some of the grains had been drawn into the air-passages by forcible aspiration, as well as into the stomach, by swallowing, and even into the duodenum. That violence had been used was proved by the marks of indentations produced by the grains of corn on the face, as well as by excoriations (indicative of resistance) on the hands. The facts were quite inconsistent with the supposition of suicide or accident; yet the jury declined to accept the medical opinion, that the deceased had been homicidally suffocated.

The presence of the grains of corn in the duodenum is not easily to be explained, considering the rapidity of death from suffocation, and that they could not be carried to the small intestine by aspiration or deglutition.

In *R.* v. *Taylor*, the accused and his wife were charged with murder. On searching their house, their three children were found lying dead on the floor of a bedroom side by side. They were of the ages of twelve, eight, and five years. One of them had been seen alive on May 14th, and their dead bodies were first discovered early on the morning of May 16th. The children had on their nightdresses; and the bodies had been carefully laid out, with their arms by their sides. There was no rigidity, but the skin of the abdomen had a slight greenish colour. In the opinion of those who first saw the bodies, the children had been dead from one to two days. The body of the eldest girl, *æt.* 12, presented no mark of violence around the neck indicative of strangulation. There was a recent bruise or scratch over the bridge of the nose, which had been produced during life. The surface of the brain was slightly congested. The lungs were of reddish colour, full of air and not congested. The heart was natural, and the ventricles contained some fluid blood. In the stomach were four ounces of a fluid resembling barley-water, without colour, smell, or any other appearance to indicate the presence of a liquid or solid poison. There was no blood, and no undue secretion of mucus; the mucous membrane was pale. All the viscera were healthy, and revealed no cause of sudden death in any part. On the body of the second girl, *æt.* 8, a slight bruise was observed over the left eye, and another bruise over the shin-bone of one leg—both recent. The body of the boy, *æt.* 5, presented no mark of violence externally. In two of the children the pupils were dilated. Internally the appearances were similar to those found in the elder girl. All the organs were healthy, and there was no apparent cause of death.

The back of the throat and air-passages presented no obstruction from mechanical causes. The conclusions arrived at by the medical men were—1st, that these children had not died from any natural cause; and 2nd, that they had not died from wounds, drowning, hanging, strangulation, or any of the ordinary causes of violent death. No trace of poison, by odour or otherwise, was found on examination of the stomachs and their contents. Portions of the intestines and contents, with some of the viscera from the bodies of two of the children, were found to be healthy; the intestines contained fæces, and were free from any indication of the presence or action of any poison. If death had resulted from poisoning—and only a powerful poison, in a strong dose, would be consistent with this state of facts—such a poison would probably have been detected either in the stomach or bowels. There had been no vomiting, and the poison had not passed off by the bowels ; hence the case was most favourable for the detection of poison if it had been present. No poison could be traced to the possession of the accused. It was suggested that the children had been killed by charcoal-vapour or coal-gas, but this suggestion was not supported either by the appearance in the bodies or by any of the circumstances of the case. Two sponges were found in the room in a wet state, and it was supposed that they had been used for applying the vapour of chloroform. Although this mode of death would leave no evidence after two or three days, yet it was considered improbable that such persons as the prisoners would have the knowledge to use chloroform, and this liquid could not be traced to their possession. There was no trace of chloroform on the sponges. As there was nothing medically inconsistent with death from chloroform-vapour, it was not absolutely excluded in the circumstances. On a consideration of the state of the bodies, and the whole of the facts proved, the conclusions which Taylor drew, and which formed the basis of his evidence at the magisterial investigations, were—1. That these children died suddenly, and probably about the same time, from a similar cause ; 2. That they did not die from any natural cause ; 3. That they died either from suffocation as a result of smothering, or from the effects of chloroform-vapour. No natural cause for sudden death could be suggested—apart from the extreme improbability that three healthy children, well supplied with food, would die simultaneously from any natural cause of which no trace could be found in their bodies. If we except the act of suffocation by smothering, no cause of violent death could be suggested. It is highly probable that these children were smothered while in bed on the night of the 14th The state of the lungs and heart was consistent with this mode of death. The dotted appearance of the surface of the lungs, described by Tardieu (*supra*), if present, escaped the notice of the inspectors. There was a mark indicative of violence on the face of the eldest, and a bruise on the face as well as on the shin of the second girl—the two who were strongest, and therefore most capable of resisting.

These marks, although slight, clearly indicated violence during life. The whole of the moral circumstances, including the writing on papers found pinned to the dead bodies, tended to show that three murders had been deliberately perpetrated, and no more probable cause of death could be suggested than that of suffocation by smothering.

Certain trials which took place many years ago proved that persons in a state of intoxication or infirmity had been murdered by smothering, for the sake of the money derived from the sale of the dead bodies. It will be sufficient to mention the trial of Burke and Macdougall in Edinburgh, and of Bishop and Williams in London, as affording ample evidence of the existence of this horrible practice. As a rule, the victims were killed by the assailant's resting with his whole weight upon the chest, so as to prevent the motion of the ribs, and at the same time forcibly compressing the mouth and nostrils with his hands, to prevent the entrance of air.

In *R.* v. *Norman*, a girl, *æt.* 15, was indicted for murder by suffocation. She was a nursery maid, and had the care of three children, the deceased, one of these children, being fifteen months old. There were three other charges against her of murder by suffocation, and one of an attempt to murder. There were suspicious marks of violence on the lower lip of the deceased, as if produced by pressure of the mouth against some hard substance. The medical witnesses attributed death to suffocation by pressure on the mouth, but conceded that the marks might have been accidental. The maid was acquitted of murder, but she was convicted of an attempt to murder. The evidence given threw light upon the method by which she might have committed the four murders with which she had been charged. One of the children, a boy, *æt.* 10, was heard to give a stifled cry of alarm while in bed. The maid was caught in the act of getting off the bed. The boy was in great agitation, and said that the maid had tried to strangle him while he was sleeping. He was awakened by feeling a hand on his mouth and throat. He tried to make a noise, upon which the maid, who was lying upon him, gave him a sweet and told him not to cry. His lips and throat were very sore.

A man was convicted at the Assizes of the Seine of the murder of a woman by placing a pitch-plaster over her face. In *R.* v. *Johnson*, a man was convicted of murder by smothering. It appeared that the prisoner, while committing a burglary, tied a woman to a bed, so that she could not move, and then tucked the clothes closely over her head ; after she had remained for some hours in this condition, the woman died.

DROWNING

Course of Events in an Ordinary Case of Drowning.
Cause of Death in Drowning—Death from Secondary Causes.
Course of Events in Exceptional Cases of Alleged Drowning.
Time Required for Death in Drowning—After how long Immersion is Resuscitation possible ?
Treatment of the Apparently Drowned.
Post-mortem Appearances in the Drowned.
Was Death caused by Drowning ?
How long has this Body been dead ?
When does a Body float ?
Was it Accident, Suicide, or Homicide ?

COURSE OF OBSERVED EVENTS IN AN ORDINARY CASE OF DROWNING

A person already in the water and who is in the full possession of his senses and whose limbs are unfettered when he begins to drown, will sink to a greater or less depth. If he falls into the water, the momentum of the body will cause it to sink in a similar manner. The buoyancy of the body or of body and clothes will cause the person to rise again, even if instinctive efforts at self-preservation are not made. On coming to the surface, violent attempts to breathe are at first made ; but, while air is received into the lungs, water passes into the mouth and some of this may be aspirated into the air passages, causing violent coughing. Either the individual can or he cannot swim, and one of two things happens In the former case, he pushes along the surface of the water till he is fatigued ; and then he is in the same case as a person who cannot swim. Whether from the outset he is in this predicament, or comes to it from fatigue, he executes irregular movements with arms and legs, seizes anything within his reach, clutches at and lays hold of all objects, whether fixed or in motion, and alternately sinks and rises. Each time that his head dips beneath the water, a portion of this is drawn into the air-tubes and cells of the lungs. The same is observed to occur when the head comes to the surface ; air and water are then inspired ; the latter is partly swallowed and partly ejected by an involuntary fit of coughing, provoked by the contact of water with the glottis. The efforts at coughing cause the expulsion of air from the lungs and an imperative desire to breathe is felt; but, the head being only partially out of the water, further quantities of air and water are taken in. The struggle for life may continue for a longer or shorter period, according to the strength of the person; but eventually exhaustion ensues, and the drowning person floats beneath the surface, opens his mouth, endeavours to draw in air, but only water enters. This is expelled from the windpipe, mingled with air; and it may be that a pint or more enters the stomach. The blood in the lungs becomes imperfectly aerated; insensibility follows, convulsive movements of the body take place, and the body sinks to the bottom.

There is a common tradition that a person in the act of drowning rises three times to the surface. This may sometimes happen, but there is certainly no reliance to be placed on such belief. That a person rises at all is due partly to the fact that the specific gravity of the body is very nearly that of ordinary water, but more certainly due to the fact that very slight movements only are required to bring the body up, for it is found that when no such efforts are made the body may sink at once on being immersed. A most graphic account of these phenomena and of the symptoms of drowning is given in the *B.M.J.*, 1894, vol. 2, p. 941, by a lady. She draws special attention to the pain experienced from drawing salt water into the lungs.

THE ULTIMATE CAUSE OF DEATH IN DROWNING

From time to time many opinions have been expressed as to the precise manner in which death takes place in drowning. These need not be mentioned, for they scarcely possess even historical interest now that every competent person accepts asphyxia as a satisfactory and complete explanation, *i.e.*, an asphyxia produced by the entry into the air-passages and cells of the lungs of an irrespirable medium which effectually prevents aeration of the blood. Asphyxia is induced in drowning owing to a physical impediment to the introduction of air into the lungs. The medium in which the person is immersed acts mechanically, and even more effectually than a rope or ligature tied around the neck; for as air escapes from the lungs, water penetrates into the minute air-tubes, and thus no air can enter to supply the place of that which has already expended its oxygen on the blood. Hence this fluid must circulate, in the first few minutes after submersion, in a state unfitted for the continued support of life (unaerated); but life continues, and is for a short time after immersion susceptible of resuscitation. After the entire suspension of respiration the action of the heart gradually slackens, and finally stops. It is at this period of complete arrest of circulation that asphyxia passes into death.

If the ordinary experiences gained by the examinations of human bodies which have been drowned were insufficient to prove this view, there are the precise scientific experiments of the Medico-Chirurgical Society to fall back upon.[1]

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[1] Report on Suspended Animation, "Med.-Chir. Trans.," 1862, p. 449.

Thus it was found by the committee that *four minutes*' complete submersion in water effectually killed dogs, although after removal from water the heart continued to beat from four to five minutes. The continuance of the heart's action furnishes, therefore, no criterion of the power of recovery.

A submersion of a minute and a half was found sufficient to destroy the life of a dog. After only one minute's submersion—or with a large dog after a submersion for a minute and a quarter—the animal recovered almost immediately on removal from the water. Other experiments showed that in asphyxia from simple privation of air, a dog would recover after *four minutes*' suspension of breathing; but, as in drowning, a *minute and a half* was sufficient to destroy life without any sign of recovery, it was obvious that some additional cause was at work to render drowning more speedily fatal than simple asphyxia. This was found to be owing not to exhaustion from struggling after the violent efforts made to breathe, nor from the effect of cold in immersing the whole of the body, but to the introduction of water by aspiration into the minute air-tubes and cells of the lungs. Two dogs of the same size were submerged at the same moment, but one had his windpipe plugged, so that neither air nor water could enter, while the other had the windpipe open. After two minutes they were taken out together. The one with the windpipe plugged recovered at once; the other died. In three experiments, dogs with their windpipes plugged were kept below the water for *four minutes*. The animals recovered perfectly when removed from the water. An inspection of the bodies at once revealed the cause of the difference. In animals simply deprived of air by plugging the windpipe the lungs were merely congested; but in those which were submerged in their ordinary condition the lungs, besides being more congested and showing ecchymosed points on the surface and in the substance, contained in their bronchial tubes a bloody mucous froth, formed of water, blood, and mucus, completely filling the small air-tubes. The respiratory efforts made by the animal before death had caused the production of this froth, which formed a mechanical impediment to the entrance of air by the movements of the chest, as in respiration. The mucous froth or foam issued from the lungs on section, and appeared to penetrate their entire substance, which was saturated with water tinged with blood. The lungs were sodden with water, heavy, soft, and doughy, so that they retained an impression produced by the finger and were incapable of collapsing. In the lungs of animals which recovered after a short submersion, little or none of this mucous froth was found in the air-cells. In the fatal cases, the quantity was great in proportion to the time of submersion. There is no doubt that it is produced by the violent efforts to breathe which are made within a minute after submersion.

This report is particularly valuable because it can be definitely accepted that the animal died directly and deliberately from drowning, and it proves conclusively that when such is the case the lungs are filled with the menstruum in which drowning takes place.

These experiments serve to explain a very disappointing termination to many attempts at resuscitation, *viz.*, that persons who have been rescued from water in a living state, and who have apparently recovered from the effects of submersion, have relapsed into unconsciousness and died after some minutes or hours. One such case will serve as a type.

The deceased was removed from the water and conveyed to the hospital. He was cold and insensible, but he breathed tolerably well, and had a fair pulse. In about three hours he became conscious, and spoke a little. The insensibility subsequently returned, accompanied by great difficulty of breathing, and he died in about twenty hours from the time of submersion.

This then is a complete and scientifically correct account of actual death from drowning; but occasionally a case is met with in which, though the immersion may have been a predisposing or even exciting cause of death, it was not the ultimate cause; for instance, the water may have been very foul, and a septic pneumonia may have supervened, or, if the person were very young or very old and feeble, mere cold and exposure may have caused fatal exhaustion, or indeed, as a last suggestion, violent efforts at escape may have burst an abscess or aneurysm. These may be termed **secondary causes of death in drowning.** No general rules can be laid down as to how such cases should be considered from the point of view of medical evidence if legal proceedings should be commenced ; each case must be decided on its own merits.

We must now, however, consider a very important fact of somewhat different nature, namely, that many bodies which are taken out of the water do not present waterlogged lungs. The explanation of such cases is of the highest medico-legal interest and importance, and must now be discussed.

EXCEPTIONAL EVENTS IN CASES OF ALLEGED DROWNING

In the above exposition of the events of drowning the primary condition was that the victim should be sensible and have his limbs unfettered at the commencement of drowning. Such a condition invariably leads to the rising of the body with the phenomena of aspiration and swallowing of water. Some persons, however, who fall into the water sink at once without any such attempts at extrication. Such an event indicates either some degree of unconsciousness or mechanical difficulties in the way of using the limbs. The latter will be discussed later when the question of accident, suicide, or homicide has to be decided ; the former may now be considered. We have the following groups of possibilities :—

(*a*) The deceased may have been stunned by the fall into the water or even have been actually killed by this means, or by his body striking some solid object in its fall.

(*b*) He may have been so intoxicated (or otherwise rendered insensible) as to have been unable to help himself.

(*c*) Fright may have produced such a shock as to have caused death by failure of the heart's action, especially if this organ were weak or diseased.

(*d*) The shock from the sudden application of cold to the skin may have caused sudden failure of the heart.

(*e*) Cramp in the muscles of the limbs may have prevented a struggle for life.

(*f*) Such cramp may have spread rapidly to or even started in the glottis or the respiratory muscles. It has been demonstrated by experiment that in drowning there is often a voluntary inhibition of respiration followed by violent compulsory respiratory efforts, and it is possible that such voluntary primary inhibition may in certain cases remain permanently till death ensues.

(*g*) He may have died from some totally independent cause, such as apoplexy, fits, epileptic or otherwise, etc., and his position at the moment of death may have been such as to cause him to fall into the water.

(*h*) He may have been killed and thrown in.

Now in all these conditions the respiratory movements will be either absent or feeble ; and it is obvious that in the first alternative the signs of asphyxia from water in the lungs will be entirely wanting, and in the latter alternative probably not very marked, or only marked in proportion to the vigour of respiration, and hence the *post-mortem* appearances will vary. Admitting, as we must, that asphyxia thus produced is the sole cause of death in drowning, these variations in *post-mortem* appearances are of the utmost medico-legal importance, for the first question that will arise in the inquiry will be, "Did this person meet his death by drowning ?" It must be admitted that, if *all* signs of death from aspiration of the medium are absent, then the cause of the unconsciousness must have been sufficient in itself to kill, if the person were submerged at the time of the occurrence of the cause for the unconsciousness. The matter will be again referred to (*vide infra*, p. 546).

It has been estimated that out of one hundred bodies removed from the water dead, where death was due either directly or indirectly to immersion, if the body were removed immediately after death and examined soon after removal, the ordinary appearances of drowning would be present in about twenty-five, they would be imperfectly apparent in about sixty-two, and they would be wholly absent in about twelve.

TIME REQUIRED FOR DEATH IN DROWNING

A medical witness may be asked what period of time is required for death to take place by drowning. Some persons who are strong, good swimmers, and retain their presence of mind, may support themselves for a long time in the water; while others who are weak, delicate, unaccustomed to the water and frightened, may struggle only for a few seconds and then sink exhausted.

The experiments detailed above show that complete submersion for one minute and a half is fatal, provided that ordinary respiratory efforts are made while submersion is complete. They further show that if respiratory efforts (by which water or air and water enter the mouth) are completely suspended, simple deprivation of air for as much as four minutes need not be fatal. They further show the reason for this difference in time (*vide* p. 537).

The power of recovery in human beings is in inverse proportion to the amount of mucous froth in the air-tubes and to the penetration of the substance of the lung with water, and, speaking generally, this amount and penetration as well as the degree of sub-pleural ecchymosis is proportional to the efforts made at self-preservation.

The explanation of the differences in the experimental times for a fatal event offers us a clue to the varied results seen in cases of accidental and suicidal drowning in which the experimental conditions do not uniformly apply. The persons concerned reach the water or become submerged in all sorts of conditions, *e.g.*, stunned, drunk, epileptic, fainting, etc., under which respiratory efforts are more or less in abeyance, the *totality* of submersion is more or less problematical, and on these factors depend the *post-mortem* results and also the time within which the different conditions appear.

The following facts have been observed :—

1. Sponge and pearl divers (without apparatus) cannot remain down for more than two minutes.

2. A woman exhibited that she possessed the ability (attained by long training for the purpose) to remain submerged for two and a half and even three minutes.

3. Complete insensibility has occurred after one minute's submersion.

4. Of two divers (with apparatus) whose supply of fresh air was cut off, one submerged for one and a half minutes lived, one submerged two minutes died.

5. Reports from the Royal Humane Society and similar bodies show cases of recovery after a minute and a half, and even after three minutes' submersion; there are longer periods recorded, but in all of them it is noted that complete submersion was doubtful.

6. In one case a girl recovered after having been six minutes under water; but it appeared in evidence that she had fallen into the water in a state of syncope.[1]

It would seem that the earlier or more loosely recorded cases of recovery after submersion for more than seven to eight minutes are wholly unreliable. It is possible that some air was drawn down in the clothing or hair of a woman or in the sail of an overturned boat, etc. Such a case actually occurred where a little dog remained for twenty minutes under the seat of a capsized boat, and was none the worse for its temporary imprisonment.

TREATMENT OF THE APPARENTLY DROWNED

Though this is hardly a medico-legal subject, nevertheless, in view of the fact that at coroners' inquests the treatment adopted by a medical practitioner may be called in question, it must receive notice in the present treatise.

When the individual is first taken out of the water, he will be asphyxiated and apparently dead, but this condition must not be mistaken for death and efforts must be made at resuscitation.

There is still some difference of opinion as to the order of importance of the methods to be used, but artificial respiration is acknowledged by all to be the most important.

In those apparently drowned, or in those actually dead, the factors that are mainly responsible for the condition are :—

(1) Absence of air from, and presence of water in, the lungs.
(2) Abstraction of warmth from the body.
(3) Exhaustion.

And hence the immediate steps to be taken for resuscitation in order are :—

(1) Wipe the mouth and nostrils, and remove as much mud, or other foreign material possibly blocking the air-passages, as can rapidly and easily be done.
(2) Proceed with artificial respiration.
(3) Strip the body to the waist, if not already naked, and dry it by vigorous rubbing with dry articles.
(4) Apply warmth to the body as soon as practicable.
(5) Avoid all violent movements, and "make haste slowly," remembering that the natural respiratory movements are only performed some seventeen or eighteen times a minute.

The combined objects of entrance of air and exit of water are attained by what is known as Schäfer's method of artificial respiration.

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[1] "Med.-Chir. Trans.," 1861, p. 149.

It may be briefly described as follows: The patient is laid face downward with a folded coat (or other object) placed beneath the lower part of the chest; the operator places himself athwart the patient's body in a kneeling posture, with his face looking towards the head of the person operated on. The hands are placed upon the lower ribs, and firm rather than violent pressure is made. The operator's body is then slowly raised, the hands being kept in position so that his weight is gradually removed. The swaying to and fro of the operator's body is repeated every four or five seconds in a rhythmic manner, so that not only is the fluid induced to flow from the mouth, but the lungs become more filled with air.[1] (*See* Figs. 46 and 47).

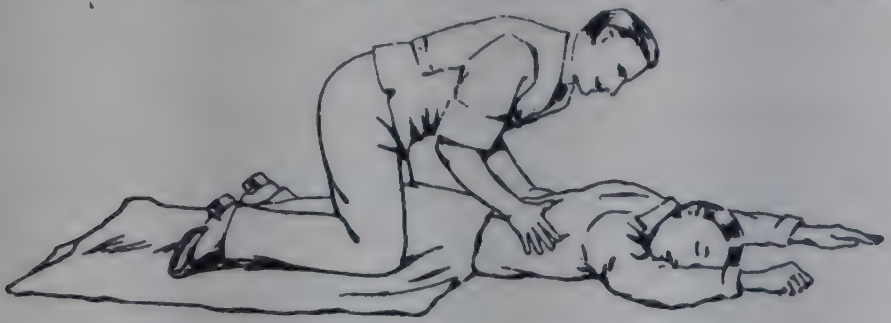

Fig. 46.—Schafer's method, Phase 1. Expiration.

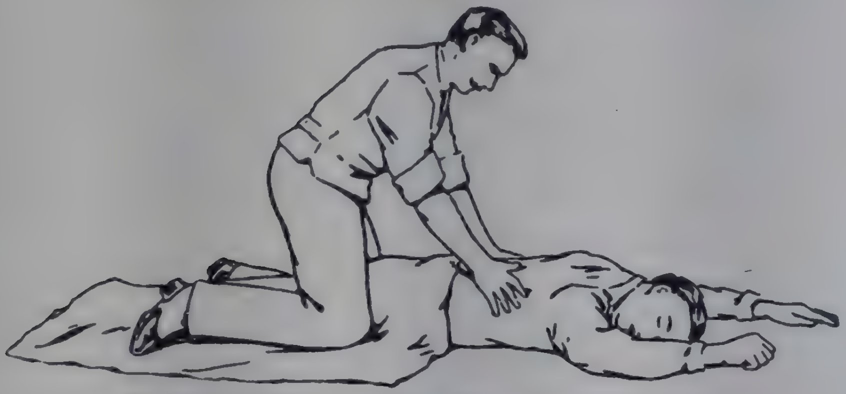

Fig. 47.—Schäfer's method, Phase 2. Inspiration.

Gibbens [2] has found that in cases of drowning at sea, Eve's rocking method has certain advantages over Schäfer's method. In this method the patient is tied on a stretcher which is balanced on a fulcrum such as a trestle about thirty-two inches high, and rocked backward and forwards at the rate of twelve to fifteen double rocks a minute. The handles of the stretcher are first allowed to touch the floor at the head end, giving an angle of about 50°, but later the downward tilt is stopped about a foot from the floor, giving an angle of about 30°. Whilst rocking, the wet clothes can be removed and the patient covered with warm blankets.[3, 4 5]

This method is less tiring than Schafer's, but requires a certain minimum amount of apparatus, which may not be at hand.

During this time, stimulants such as ammonia, aromatic vinegar, etc., may be cautiously applied to the nostrils, in the hope of producing reflex efforts at ordinary respiration. Injections of strychnine or coramine may be tried. The use of oxygen combined with five to eight per cent. carbon dioxide provides a useful stimulus to respiration. Drowning cases always suffer from shock, and steps should be taken to combat this. The wet clothing should be removed at once without interfering with the artificial respiration and warmth applied by means of hot blankets and other coverings. When the power of swallowing returns, but not before, warm water, alone or with a little brandy as a stimulant, may be given. The patient should then be placed in bed and allowed to sleep.

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[1] *Proceedings of Royal Society of Edinburgh*, vol. 25, part 1, p. 49.
[2] Gibbens, G. H., *B.M.J.*, 2: 751 (1942).
[3] Killick, E. M., and Eve, F. C., *Lancet* 2: 740 (1933).
[4] Med. Res. Council Rpt. 239 (1939)
[5] Eve, F. C., *B.M.J.*, 1: 535 (1943)

POST-MORTEM APPEARANCES IN THE DROWNED

In conducting the examination of the body of a drowned person, it is necessary to remember that the external and internal appearances vary according to the length of time during which the body has remained in water or the period that has elapsed after its removal and before it is examined (*vide* "Decomposition," p. 251). Thus, in reference to the bodies of two persons drowned by a common accident, if one is examined immediately, and the other is not removed from the water until after the lapse of several days, and is then inspected, the appearances will be different. So if two bodies are removed at the same time, and one is immediately examined, while the other is not inspected until a few days after removal, the proofs of drowning which may be discoverable in the former will have disappeared in the latter.

It is impossible to lay too much stress on the necessity for examining *as soon as possible* a body taken out of the water. The rapidity with which putrefactive changes occur in bodies taken from the water and the rapidity with which some of the most essential signs of asphyxia from the aspiration of water may disappear are very extraordinary.

External Appearances

Supposing that the body has remained in the water only a few hours after death, and the inspection has taken place immediately on its removal, the *skin* will be found cold and pallid, sometimes contracted, in the form of "cutis anserina," or goose-skin. Casper considers this to be a usual accompaniment of death from drowning, but the condition is due to the contraction of the erector pilæ muscles and is found in many forms of death. It may be produced after death, as has been more than once observed. Bogdan[1] describes a case in which cutis anserina and retraction of the scrotum and penis occurred twenty-eight hours after death. This was caused by placing ice in contact with the body. Sudden fright or sudden application of cold to the skin usually produces goose-skin, and therefore it is commonly found when a body has fallen into water in a living state.

In men who have fallen into the water alive and have been drowned, a remarkable contraction of the penis has been repeatedly observed. No deduction as to death from drowning can, however, be made from the condition of the penis. Ogston states that he has more than once seen it in a condition of erection or semi-erection, and certainly, if we consider the mechanism by which erection or the reverse is brought about, there can be no difficulty in accepting either condition as perfectly compatible with drowning or death from any other cause.

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[1] *Annal. de méd. légale*, September, 1922.

The skin is often covered to a greater or less extent by livid discolourations. These may be bright red if the water was cold. The face is pale and calm, with a placid expression; the eyes are half open, the eyelids livid, and the pupils dilated, the mouth closed or half open, the tongue swollen and congested, frequently pushed forwards to the inner surface of the lips, sometimes indented or even lacerated by the teeth; and the lips and nostrils are covered with fine lather-like froth which oozes from them. If wiped away it tends to recur.

The sodden and wrinkled skin ("washerwoman's hands") is caused by the action of water on the skin, and has no bearing on how death occurred, though it may be important in enabling us to state approximately how long the body had lain in water (*vide* "Decomposition in Air and Water," with reference to this and the changes of putrefaction, p. 213).

The body and limbs of a person recently drowned are usually found relaxed; but cadaveric rigidity appears to come on quickly, and the body is often stiffened in the convulsive or distorted attitude which it may have had at the time of death (*vide* "Instantaneous Rigidity"). A medico-legal question may arise in reference to this condition of the dead body. In one case, the body of a man who was drowned under ice was found with the arms stiffened in the attitude in which he was endeavouring to support himself on the ice.

Careful notes must be made of any abrasions on the fingers and elsewhere on the body. Such are easily explicable by the fact that in the act of drowning a person will grasp at any object within reach, and in his efforts to extricate himself may easily excoriate his fingers or even tear them badly, especially the nails, in trying to get a grip on a hard body too large for the grasp of the hand. Precisely the same explanation will account for the presence of gravel, sand, mud, weeds, or any substance found locked within the hands or beneath the nails, the precise nature of which it is most important to notice. Substances floating in the water are sometimes found in nose, mouth, or ears. The presence of all these things is of much more importance as evidence than their absence, for it is obvious that there may be, especially in deep water, or in water with smooth but hard enclosing boundaries, or in many other circumstances, nothing for the drowning person to grasp. Again, if he were insensible, or in a state of syncope, he would not be capable of making the exertion necessary to produce conditions such as those described.

External appearances of themselves, *i.e.*, without explanation of their causation, are of little or no value in determining the fact of death from drowning.

Internal Appearances

On examining the body of a recently drowned subject, the lungs and heart present the appearance usually indicative of asphyxia. The venous system is generally gorged with dark-coloured blood, which may be found either coagulated or uncoagulated in those who go into the water living and die by drowning. If death has not taken place from asphyxia, or if the body has remained a long time in water before an inspection is made, the lungs and heart will not present the characters about to be described.

The lungs, if the person has died by drowning with the usual occurrences (*vide* p. 535), will be found distended, completely filling the cavity of the chest, and owing to the penetration of their substance by water they have lost their usual elasticity. Hence an impression made upon them by a finger is preserved. A similar preservation of a finger impression is also seen in emphysema, but here dryness of the lung is a marked feature. On making a section of any part of the lungs a bloody, frothy liquid escapes, air and water being mixed together in the air-cells. The appearances above described are only likely to be observed in a well-marked form when the body is examined soon after death. The *windpipe*, *bronchi*, and minute *air-tubes* of the lungs, in a recently drowned subject, are filled more or less with a *watery mucous froth*, tinged with blood, as a result of the last violent efforts at respiration. From the experiments mentioned on p. 537, it would appear that its presence in the air-passages does not depend on the fact of the person rising to the surface, although this may increase the quantity, but rather upon the violent spasmodic efforts made to breathe in circumstances in which water alone can enter the lungs.

A dog was kept entirely under water for three minutes and a quarter. It made the usual convulsive efforts to breathe while in the water, but not after removal from it, as the animal was then dead. A bloody froth escaped from its mouth, and on inspection its lungs were found to be filled with this froth. Another dog was submerged for a minute and a half. When removed it opened its mouth, but was unable to make any respiration : it was dead. A large quantity of bloody froth was found in the air-tubes and lungs. A dog was kept with its head below water for one minute, and it recovered when withdrawn from the water. An hour afterwards it was inspected, and there was but little froth in the lungs.

These facts show that the froth is produced, even in two minutes, when there is entire submersion of the head ; and its quantity appears to be in proportion to the length of submersion and the violence of the efforts made to breathe.

This presence of watery mucous froth in the air-passages may be regarded as the particular characteristic of asphyxia from drowning, and when discovered in any large quantity it furnishes a presumption of this mode of death. The exact method by which it is produced has given rise to considerable discussion. On the one hand, it is maintained by some that it is simply aspirated water mixed with air, while others take the view that it is largely composed of mucus and air. Mucus is a product of the lining membrane of the air-passages, and its secretion is a vital act. Hence we can easily understand that the longer life has continued, and the fiercer the struggle for it, the more likely there is to be a considerable proportion of mucus in the froth, and also the more likely to be increased absorption of water. This view is distinctly in accord with the results of experimental drownings, and is probably correct. From a medico-legal point of view, this is a matter of no interest beyond the suggestion that little froth means rapid death, and *vice versa*, which might conceivably be a factor in determining survivorship.

In some cases the contents of the stomach may be found in the windpipe and lungs ; this is apt to occur when a person has been drowned with a full stomach. Vomiting has taken place, and the vomited matters have been drawn into the lungs by attempts to breathe during the act of vomiting. For further particulars of such cases *vide* " Suffocation."

The sub-pleural hæmorrhages (petechiæ) noticed under the heading of asphyxia, are seldom observed in drowning, but when present they offer corroborative evidence of this form of death.

The Heart. The heart, in cases of drowning, has been found in every variation of fullness and emptiness on the two sides : both empty, right full and left empty, and both equally full. Hence as evidence of the kind of death its condition is valueless. In the first place, the heart continues to beat some time after respiration has ceased, and therefore the condition might on this ground be simply that found in any form of death, and this is variable ; in the second place, we must remember that *rigor mortis* occurs in the heart, as in any other muscle, and the contraction of *rigor mortis* may be capable of emptying the chambers and keeping them empty provided that the blood is still fluid when *rigor mortis* set in. That the right ventricle is much weaker than the left would easily account for the fact that, though both may be empty, the right never contains less blood than the left.

The Brain. A greater or less fullness of the vessels of the *brain* is described as one of the appearances met with in drowning ; but this, when it exists, is probably a consequence of the difficulties in circulation of the blood. It is evident that the state of the cerebral vessels can afford no presumption that death has taken place by drowning. It is only on rare occasions that the quantity of blood contained within the cerebral vessels is so great as to call for particular notice. The obstruction to the passage of the blood through the lungs is sufficient to explain why we meet with congestion in the vessels of the brain in the body of a drowned person. Extravasation of blood within the brain or on the surface of the brain is rarely seen in the drowned ; and when it exists, it may be the result of mechanical violence before submersion, or of the head's contact with hard substances beneath the surface of the water.

The Stomach. In examining the abdomen, it will usually be found that the *stomach* contains water, which has been swallowed during the struggle for life. This may be salt or fresh, clean or dirty, according to the medium in which the drowning has taken place. The quantity is subject to great variation : sometimes it is large, at other times small, and in some instances no water whatever is found. The absence of water may probably indicate a rapid death, which took place while there was no power to swallow.

Obolonsky made a number of experiments in order to show whether water could or could not enter the stomach after death. This experimenter determined definitely that such entry was possible, but was extremely improbable under the ordinary conditions of drowning. It is, however, very important to note not only the actual quantity of any water found in the stomach, but also the presence of foreign substances such as portions of algæ, water weeds and mud.

The Blood. In all deaths from asphyxia, except in poisoning by carbon monoxide and a few other gases, the blood is dark and fluid. The dark colour is accounted for by the absorption of all available oxygen, and consequent reduction of the hæmoglobin to an unoxidised form. The fluidity is promoted also by this want of oxygen, but in drowning there is another factor to be taken into account, viz., absorption of water into the blood from the lungs, and possibly also from the stomach. The fact that the heart continues to beat after the lungs have become waterlogged, causes interesting alterations in the distribution of salts in the two sides of the heart and in the state of the red cells which are described later.

There are no *post-mortem* appearances other than those mentioned which have any special interest in a case of drowning, but the exact condition of every organ is of importance in answering our next question, Was death due to drowning ? A typical case indicating the importance of this occurred some years ago at the London Hospital.

A small boy, about five years of age, was ordered to be placed in a warm bath for some little time. The nurse, who was holding him, was unfortunately called away. She was absent not more than two or three minutes, and on her return found the child dead beneath the water. *Post-mortem* examination showed no trace of water in lungs or stomach. The condition of the blood and brain was absolutely natural. It was only on examining the left kidney that the cause of death from shock was explained. There was found a large calculus which had shifted from the renal substance and suddenly blocked the ureter, no doubt causing such agony that the child had died there and then from the shock of it.

For a full report, with several cases, on the appearances in the drowned, *vide* Harvey Littlejohn in *Edin. Med. Jour.*, February, 1903[1].

WAS DEATH CAUSED BY DROWNING.

For a correct solution of this question it will be necessary to consider how far the appearances met with in the drowned are pathognomonic of this form of death. Among the *external* signs of drowning when the body is seen soon after death are the presence of watery mucous froth about the nostrils and lips, paleness of the surface, and a contracted state of the skin (cutis anserina). The absence of these appearances, however, would not prove that the person had not been drowned ; for if the body had remained some time in water, or if it had been long exposed to air before it was seen by a medical man, the skin may have undergone various changes in its condition, and mucus and froth might no longer be found adhering to the nostrils and lips.

The goose-skin, or cutis anserina, which is frequently observed in the drowned, suggests that the skin possessed the living power of contractility at the time of immersion. It is not always present, however, and even when present it has no more value than has the fact that the body was pulled out of the water, so far as death *from* drowning is concerned.

Substances Grasped in the Hands. In speaking of the *external* appearances of the body, it was stated that foreign substances are sometimes found locked within the hands, or lodged under the nails of drowned persons. This fact may occasionally afford strong circumstantial evidence of the manner in which a person has died. If materials are found grasped within the hands of the deceased which have evidently been torn from the banks of a canal or river, or from the bottom of the water in which the body is found, we have strong presumptive evidence that the person died in the water ; for although it is possible to imagine that the deceased may have struggled on the bank, and have been killed prior to submersion, yet in the value attached to this sign, we are assuming that there are neither marks of violence on the person nor any appearances about the body sufficiently striking to lead the examiner to suspect that death had occurred in any way other than by drowning. If the substance locked within the fingers or finger-nails is of the same nature as that at the bottom of the river or pond, or consists of portions of weeds growing there, it is difficult to think of any stronger evidence to establish the fact that death took place subsequently to submersion. The abrasion of the fingers is a circumstance of minor importance ; no value could be attached to this state of the fingers as an indication that death had been caused by drowning, unless it were in conjunction with the appearances above described. A medical witness would concede in many cases, that the fingers might become abraded or excoriated after death, or even before submersion ; while in no case could he be called upon to make, in regard to substances found grasped within the hands, an admission which would invalidate the evidence deducible from this condition. This must be regarded as a satisfactory proof that a person was alive after his body was in the water. It is well known that when two or three persons are drowned by the same accident, they are not infrequently found clasped within each other's arms—a fact which at once proves that they must have been living when submerged. So if a dead body is discovered still holding to a rope, cable, or oar, no further evidence is required to show that the deceased must have died in the water, provided that there is no other evidence forthcoming as to possible death before falling into the water and instantaneous rigor. Such instantaneous rigor, with contraction of hands and feet, lasting till putrefaction sets in, is perhaps more common in drowning than in any other form of violent death met with in civil life.

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[1] Or "Forensic Medicine" (J. & A. Churchill, 1925), by the same author, p. 37.

The **Internal appearances** upon which medical witnesses chiefly rely as proofs of death from drowning are—water with a mucous froth in the air-passages and lungs ; water in the stomach ; and changes in the blood.

Water with Mucous Froth in the Air-passages. If the body is removed from the water with care, and is examined at a sufficiently early period, these appearances will furnish satisfactory evidence of death from drowning. The mucous watery froth is generally tinged with blood ; its mode of production has been described above (*vide* p. 544), and it may be considered to furnish valuable evidence of death from drowning when observed in a body which has been taken from the water. Froth at the nose and mouth and froth and fluid in the air-passages is found in deaths from other causes—for example, in uræmia and in acute œdema of the lung. On the other hand, its absence does not necessarily prove that a person has not died from drowning. A mucous froth may not be found when the body has remained for a long period in the water after death, since the froth, although formed in the first instance, may have disappeared. If, after removal from the water, the body is exposed to the air for several days before it is examined, it is rarely that this appearance is seen.

Foreign Bodies in the Lungs. Not only is water thus drawn in, but sand, mud, weeds, or other substances floating in it, are also carried into the air-tubes and spaces of the lungs. When the water is mixed with weeds or mud, and water presenting the same admixture is found in the throat and stomach, this is strong evidence that the body has been plunged into the medium when the power of breathing and swallowing still existed, and hence that the deceased has been drowned.

When a dead body is thrown into the water, and has remained there some time, water, fine particles of sand, mud, weeds, etc., may pass through the windpipe into the large air-tubes. In these circumstances, however, water does not penetrate into the smaller bronchi and alveoli as they do by aspiration, and the amount which passes through the chink of the glottis is small. If simply an after-death effect, the water is found only in the larger air-tubes unaccompanied by mucous froth. In most cases, however, the effect of aspiration, as a result of living power, is so manifest that the examiner can have no difficulty in forming an opinion. There seems to be no evidence of an experimental kind to show that in any circumstances, even those of advanced decomposition, water with suspended matters can penetrate even to the larger air-tubes in anything more than the very smallest quantity, unless aspirated thereto by respiratory efforts during life, and *à fortiori* none that such matters can penetrate to the spongy lung substance without similar aspiration.

As in the case of the stomach, so with the lungs, it is the quality, or nature of the suspended matters that is of most critical importance of which the following case is an excellent example :—

Chevers was required to examine the body of a child found dead in a tank at a distance from the house of its parents. The internal appearances showed that the child had died from drowning. The air-passages contained green vegetable matter, and the right air-tube was almost completely filled with so large a portion of an aquatic weed doubled together, that it appeared astonishing how such a body could have passed into the windpipe. It was proved that no weed of this kind was growing in the tank in which the dead body was found ; and further inquiry led to the discovery that the body of the boy had been found by a woman in a tank near his home, in which a weed like that taken from the air-passages grew abundantly. She had conveyed the corpse to the more distant tank, which belonged to a person against whom she bore a grudge.

The only reasonable explanation of the facts was, that the child must have been living when placed in the tank in which the weed grew, and have drawn it in by its efforts to breathe. Its presence indicated a living act, and that the body was not put into the water of the first tank after death, but when dead it was subsequently carried to the second tank, and placed there for a malicious purpose.

The great cause of failure in obtaining medical proofs of drowning is generally the unavoidable delay before an inspection is made.

The two following cases illustrate the contention very well :—

In an inquest, it appeared that the body had been three weeks in the water. One medical witness said that from the presence of water in the stomach, and the fluidity of the blood, his opinion was that the deceased had died from drowning. Another contended that from the lungs being found in a collapsed state, death had not taken place from drowning. The jury could therefore come to no satisfactory verdict.

The proper course in such a case would have been to state that the changes which had taken place after death had rendered it impossible to form a correct opinion.

In *R.* v. *Kirwan*, a question arose as to the length of time which had elapsed before the body of the deceased woman had been inspected. On the day following its removal from the water, the body was superficially examined *externally.* Thirty-one days after death, and twenty-six days after burial, it was exhumed, and a proper inspection made. The lungs were found engorged with blood; the heart empty; the stomach empty and contracted. The absence of the usual appearances found in recent cases of drowning was considered by some of the witnesses to prove that the woman had *not* died from drowning, but that she had died from some other cause, and that her body had been afterwards placed in the water. Considered apart from the non-medical evidence, the inspection of the body threw no light what ever upon the cause of death. Medical evidence based upon appearances so long after death is untrustworthy.

The general impression among non-medical persons appears to be that, whether in drowning or suffocation, there ought to be some particular *visible change* in some parts of the body to indicate at once the cause of death; but this notion is founded on false premises. A medical inference of drowning is founded upon a certain series of facts, to each of which, individually, it may be easy to raise plausible objections; but taken together they furnish evidence as strong as is required.

The two following cases are instances of death from epilepsy and suffocation, which are interesting and instructive in this connection :—

A man was in the act of leaving an outdoor closet, when he was seized with an epileptic fit, and fell with his face in a pool of dirty water, which did not exceed a foot and a half in breadth, with a depth of from three to four inches. When discovered after death, only his mouth and nostrils and one cheek were found to have been under water.

A gentleman, *æt.* 30, had retired to his dressing-room apparently in good health. Some time later, upon breaking open the door, his body was found lying in a sponge bath. He was dead, but there was still some warmth about the body. He was lying on his face in the bath, with his nose and mouth below the level of the water. Some time before he was thus discovered, a fall had been heard in his room, but no particular notice was taken of it. The body was inspected twenty-four hours afterwards. Externally there was a recent wound of the skin of the right arm above the wrist, evidently caused by pieces of a washhand basin which had been broken. There was much congestion of the brain and its membranes. In the right ventricle, only a small clot of blood was found; with this exception, the cavities of the heart were perfectly empty. The right lung was healthy, and presented no congestion; the left was wasted, but slightly congested. The medical and other evidence showed that, although the body was found with the face under water, the deceased had not died from drowning, but that he had been seized with a fit—probably epileptic; that he had fallen into the sponge bath, breaking the washhand basin in the fall, and thus producing the recent wound of the right arm. It transpired that he had previously had two epileptic fits.

The position may be thus summarised. If water (and things in the water of the locality) is found aspirated into the lungs, death was certainly due to drowning: the less evidence there is of this aspiration of water the more weight must be attributed to any other possible cause of death found or hinted at: if there is *no evidence of aspiration of water* the person was not drowned, but died from something else which it may or may not be within the possibility of evidence to determine.

Water in the Stomach. In death from drowning a certain amount of water is swallowed. Experiments have repeatedly proved that if a dead body be placed in water with the mouth forcibly kept open, water does not enter the stomach in quantity sufficient to cause any doubt. It has been suggested that water may be found in the stomach of a person apparently drowned in consequence of this liquid having been drunk by the deceased or artificially injected by another into the stomach after death. It is difficult to conceive in what circumstances the latter objection could be made, or what purpose it would answer. In relying upon the presence of water in the stomach, it may be admitted that the deceased may have drunk water before his body was submerged.

The body of a child, aged two years, was taken out of a stream of water and inspected. The usual appearances of drowning, with the exception of water in the stomach, were absent. The presence of water in the stomach was explained by the fact that the child had been playing with its nurse on the banks of the stream. It complained of intense thirst, and the nurse gave it a copious draught of water. Almost immediately after this, the nurse having walked away, the child must have fallen from the bank into the water.

The discovery of water in the stomach is not, therefore, a necessary proof that it has been swallowed during the act of drowning.

It is, of course, presumed that the liquid contained within the stomach is of the same nature as that in which the body is immersed, for it is possible that fresh water may be found in the stomach of a person drowned in salt water. If the water contains mud, straw, duckweed, moss, diatoms, or any substances like those existing in the pond or river where the drowning occurred, this is a proof, when the inspection is recent, of its having been swallowed by a living person. Of this fact examples are too common to be worth mention.

The absence of water from the stomach cannot, however, lead to the inference that the person had not died from drowning, because in some instances the victim may be deeply unconscious and unable to swallow.

Hence, as a final summary of the import of water in the stomach, it may be definitely said (1) that a *large* quantity of water of the same nature as that in which the body is found is strong presumptive evidence of immersion during conscious life, and therefore of death from drowning; (2) that small quantities give no certain indication unless the inspection is made very shortly after death; (3) that the quality—*i.e.*, dissolved or suspended matters—is of much more importance than the quantity.

Alterations in the Blood. The layers of vascular and alveolar epithelium in the lung may be regarded as a semi-permeable membrane, and when the alveolar spaces are filled with a drowning medium, the passage of fluid and electrolytes will occur. No doubt there are many factors which will determine the relative effects of endosmosis, exosmosis and imbibition in such circumstances, but the net results will tend towards producing an equilibrium between the blood in the lung capillaries and the sea or fresh water in the lung spaces. As the circulation is usually maintained for a short but appreciable time after the lungs are filled, these results will be found noticeably in the blood on the left side of the heart.

In drowning in sea water, the lungs are filled with a fluid of greater density than the blood plasma. Osmotic exchange will result, therefore, in a relative increase in the blood salts, an increase which will be detectable mainly or solely on the left side of the heart. In drowning in fresh water, the fluid in the lungs has a lower salt content than normal blood plasma, and the results of osmosis will be to produce a dilution of the blood salts, that is to say, a relative diminution, again detectable to greatest degree on the left side of the heart. The effect of such changes on the red corpuscles will tend to cause crenation in the one case, and lysis in the other. In addition to the normal exchange by osmosis there is reason to believe that direct absorption of salts from the fluid in the lung into the capillaries takes place with a consequent actual increase of salts in the blood in the left side of the heart.

Observations so far recorded have been mainly of the plasma chlorides, and results have accorded with the expectations raised by the above discussion. Gettler, A. O., found the chlorides disproportionately high on the left side of the heart when drowning was in salt water.[1] In a series of experiments by Jetter and Moritz, the chloride and magnesium contents of the blood on both sides of the heart were found raised immediately after death from drowning in salt water, the increase being greater on the left side. These increases were significantly maintained even after putrefaction had commenced, and there was delay in the *post mortem* hæmolysis of the blood in the heart.[2]

Although progressive loss of plasma chlorides is a normal *post mortem* phenomenon, observations in a corresponding series of experimental drownings in fresh water showed a reduction in chlorides on both sides of the heart, within fifteen minutes of death, to levels not found in control animals till much later in the *post mortem* period. Early hæmolysis of the blood was a striking feature.

Examination of samples of blood collected separately from the right and left sides of the heart may thus be of considerable value in determining whether death was due to drowning. It must be realised, however, that there are circumstances which may nullify the practical application of the tests indicated above. Significant changes in the blood are dependent on the circulation being maintained for an appreciable time after the lungs are filled with fluid, and this does not invariably happen. The agonal and early *post mortem* differences of significance tend to disappear as putrefaction progresses, and many cases are only brought to examination after putrefaction has become well advanced in the drowning medium. At present, therefore, it can only be said that appropriate testing of the blood from the heart, taken in conjunction with other findings, may furnish useful and even conclusive evidence of death from drowning in selected cases

According to Moritz, an increase in magnesium occurs in the blood in 12-24 hours after death, irrespective of the cause of death.[3] This increase is indicative of the onset of putrefaction, and, in the presence of putrefaction, a diminution in plasma chlorides becomes less significant. It would seem advisable, therefore, to ascertain the magnesium level as well as that of the plasma chlorides, in order to provide a check on the significance of the latter figure, especially in cases of suspected drowning in fresh water. The same considerations do not apply to sea water, in which the chloride and magnesium contents are approximately 5 and 44 times that of normal plasma.

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[1] Gettler, *Jour. Amer Med Ass.*, 1921; Yamakami, *Tokio Jour. Exp: Med,.* 1923.

[2] Arch. Path. 35 : 601 : 1943.

[3] "The Pathology of Trauma," p. 170 (1942)

HOW LONG HAS THE BODY BEEN DEAD ?

A medical man may occasionally be required to express an opinion on the length of time that may have elapsed since the act of drowning, when the dead body of a person has been discovered in water. The rules which have been suggested for the guidance of a medical witness on these occasions are given at pp. 234 and 251 *et seq.* They are open to so many exceptions, owing to the different degrees in which putrefaction takes place in bodies exposed in similar circumstances, that they are of little service as a basis for medical evidence. On the production of adipocere as a result of the decomposition of the body in water, and the properties of this substance, see pp. 217 *et seq.*

In connection with this question of the length of time which has elapsed since death, a subsidiary one may arise, *viz.*, **when does a dead body in water float** ? At the trial of Spencer Cowper for the alleged murder of Sarah Stout,[1] the buoyancy of the human body living and dead, formed an important part of the inquiry. But the medical facts in connection with putrefaction were then but little understood, and the evidence given was quite unreliable.

The specific gravity of the human body in the *living* healthy state is made up of the combined specific gravities of its different parts ; so that, as in all heterogeneous solids, it is a very complex quality. In the first place, about 73 per cent. of the weight of the body consists of water—hence the question of specific gravity can refer only to the remaining 28 per cent. of dry solids. The only part of the body which is lighter than water is fat. The specific gravity of this is 0.92, and it is calculated that the proportion of fat in an adult is about 5 per cent. of the weight of the body, or one-twentieth part. The specific gravity of muscle is 1.085, of brain 1 04, of the soft organs generally 1.05, of the lungs containing air 0.94, and of bone, the heaviest part of the body, 2.01. The lightness of the fatty portions is more than counterbalanced by the weight of the skeleton (about ten and a half pounds in the male, and nine pounds in the female), so that the naked human body, placed on water, has a slight tendency to sink. An inexperienced person exhausts himself by exertion, raises his arms continually out of the water, and as often sinks, owing to their weight having just so much effect on his body as if a weight had been suddenly applied to his feet to sink him. When the *whole* of the living body is immersed, the specific gravity, owing to the expansion of the chest, differs so little from that of water that a very slight motion of the hands or feet will suffice to keep a person on the surface. The head, owing to the weight of the bones of the skull, has always a tendency to sink below the level of the water.

There are two circumstances which cause the specific gravity of the body to vary. If the quantity of *fat* is proportionately large, it will be diminished, and such a person will float more readily than another in an opposite condition. On the other hand, a large proportion of *bone* renders a person heavier than his bulk of water ; and his body will sink more rapidly than that of another. These two modifying causes of buoyancy are liable to variation ; hence the different accounts given by experimentalists relative to the specific gravity of human bodies. The bodies of women are, *cœteris paribus*, of less specific gravity than those of men ; the skeleton is smaller, and there is a greater proportion of fat—hence they more readily float. Infants and young children float more readily than adults ; the quantity of fat is usually in large proportion, and the bones are light, the earthy matter being not yet fully deposited. Thus, in infanticide by drowning, the body of the child rises very speedily to the surface, if, indeed, it does not persist in remaining near it.

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[1] See "Famous Trials of History," p. 89, Birkenhead, 1926.

The buoyancy of the body depends to a considerable extent on the condition of the lungs. If these organs are emptied, and the chest contracted, then the specific gravity is considerably increased ; hence it follows that, *cœteris paribus*, a person with a large and capacious chest floats more easily than one whose chest is small and contracted. Hence, also, in a living person the body has a tendency to rise out of water during inspiration, and to sink during expiration, the quantity of water displaced under these two opposite conditions of the respiratory organs being very different. The entrance into water with the chest nearly emptied as the result of a loud scream or shriek, is very unfavourable to the buoyancy of the body.

The fact of the *clothing* being on the person may also make a difference, either from its nature, in serving to buoy up the body, or from its weight to sink it more deeply. Women are sometimes saved from drowning because their clothing floats, and thus presents a large surface to the water ; it is partly owing to this circumstance that their bodies often remain floating on the water immediately after death. This happened in the case of Sarah Stout above. In a case of suicide, it was proved that the body of the deceased floated on the sea water for half an hour after the act of drowning ; it was probably buoyed up by the clothing. But it is to be observed that the specific gravity of sea water is 1.026. This differs but little from the specific gravity of the muscles and soft organs ; hence the human body floats much more readily in salt than in fresh water, and, indeed, except for the weight of the skeleton, it would have but a slight tendency to sink in the sea.

The human body, when it rises to the surface from putrefaction, usually floats belly upwards. This is owing to the abundance of gas in the intestines and to the fact that the spinal column with its bones is heavier than the anterior wall of the abdomen, so that the trunk, unless anchored as it were by the hanging limbs, assumes a position of stable equilibrium, *i.e.*, a position in which the centre of gravity is as low as possible.

It may be laid down as a general rule, that the recently *dead* unclothed body is, when left to itself, *heavier* than water, and sinks when immersed. The expulsion of air from the lungs and their penetration by water, and the fact that the bones and all the soft parts, excepting the fat, are of greater specific gravity than water, offer a sufficient explanation of the sinking. After a variable period, generally not more than a few days, the body will rise again to the surface and float. The period of its rising will depend : (1) on the specific gravity of the body ; (2) on the nature of the water, whether salt or fresh ; (3) on the action of heat and air in facilitating putrefaction. If the gases generated find an escape, the body will sink ; more gases may form, and then it will again rise, so that the sinking and rising may become alternate phenomena. But a dead body, whether death has been caused by drowning or not, may not sink at all, owing to some counteracting cause.

WAS DROWNING THE RESULT OF ACCIDENT, SUICIDE OR HOMICIDE ?

This question is more complicated on paper than in practice, for, as a rule, there is a body of collateral evidence which, in itself, renders medical evidence of secondary importance. The subject must all the same receive our earnest consideration apart from such influences.

Naturally, the actual fact of death from drowning has first to be established; this we have sufficiently discussed. A person may be suffocated, or may die from epilepsy, apoplexy, or from a sudden attack of any other fatal disease which may or may not be indicated by well-marked appearances after death; the body is thrown into or falls into water, and remains there a few days. When taken out, water may be found in the lungs, but there may be none in the stomach; there may be no mucous froth in the windpipe, and the lungs may be more or less congested. In the case of a suffocated body, without marks of external violence, it would be impossible to determine whether death had actually taken place within the water or not, since persons may die in water or at the moment of immersion, in circumstances in which the appearances of drowning would be either obscure or entirely wanting. Such cases have already been illustrated.

Again, if in examining a body taken from the water we find the appearances of disease sufficient to destroy life, there is a *prima facie* ground for suspicion and inquiry. Why the body of a person who has really died from natural causes should be afterwards thrown into the water may or may not receive a satisfactory and innocent answer, but the question must be asked.

A child was alleged to have died from convulsions and its body to have been thrown into the water, but medical evidence clearly proved that death was due to drowning.

In this case, no accidental falling in was suggested, but there is no reason why an adult should not be standing close to the water and fall in when taken with a fatal attack of disease. The following case well illustrates the value of medical evidence in certain cases.

In *R.* v. *Griffin*, a woman was charged with the murder of her child by drowning it. She alleged that it was dead when thrown in the water. The lungs were found to be congested and contained mucous froth, which was also found in the windpipe mixed with sand, particles of which were seen in the smaller air-tubes. The lungs were fully distended. The heart contained on the right side fluid blood; the cavities on the left side were empty. All the organs were healthy. The appearances were only consistent with death from drowning. The judge asked the medical witness whether he was not influenced in forming his opinion by the fact that the body of the child had been found on the bank of a river. The witness said that he would have come to the same conclusion, even if he had not known of that circumstance. He was perfectly justified in that view by the appearances, since there is no disease affecting children which will produce them. If the child had had convulsions, it had been exposed while living to the action of water. The woman was convicted.

Marks of Violence. The greatest attention must be given to marks of violence, whether external or internal. The violence may have been so great as to account for death if inflicted on the living; on the other hand, the injuries may be slight, but of peculiar character. *R.* v. *Carnt* is particularly instructive in this respect, as the marks on the body of the victim were very slight, and it required great acumen to interpret them correctly.

The body was removed after it had been lying about four hours in the water, and was carefully examined forty-one hours after death. The right eye was ecchymosed, the pupils slightly dilated, the lips bluish, and there were bluish patches on the face. *Slight scratches were visible on the right side of the face.* The skin had a dull leaden hue. The jaws were fixed, the teeth tightly clenched, and the tongue not protruding. The nails were filled with sand and mud. *There were severe bruises on both arms near the elbow, equal in extent and intensity.* The tongue was greatly congested, and covered with froth and mud, which extended backwards to the throat and nostrils as well as into the larynx and windpipe, and the upper divisions of the air-tubes of the lungs. The lungs were engorged and greatly distended: when cut in any part, frothy bloodstained mucus was abundantly poured out, and a watery liquid escaped on pressure. There were small pieces of green weed in the air-tubes, corresponding to weed in the pond. The vessels of the neck were distended with dark-coloured liquid blood, without any coagulum. The stomach was healthy, and it contained partially digested food, with about a pint of liquid mixed with mud and sand.

Image gave an opinion, which was perfectly justified by these appearances, that the deceased had died from drowning, and that she had probably been held forcibly under water. The accuracy of this opinion, in spite of an attempt to overthrow it by the defence, was confirmed by the confession of the convict before he was hanged.

In the same connection the following cases are also instructive :—

In an accident, a man and his wife were thrown into the water by the overturning of a small boat. The woman was drowned. On an examination of her body, a livid circle was found round her neck, as if she had been strangled, but no ligature to account for it. She had evidently died by drowning, and the mark on the neck had been produced by the string of a cloak which she wore at the time of the accident. In her struggles to reach the boat, it is presumed that the tide had drifted the cloak in an opposite direction, and had thus produced the usual appearance of violent strangulation. It is not improbable that the constriction accelerated death.

In cases of this description, circumstantial evidence would usually show how the mark had originated. Circumstances, as matters of proof, do not always present themselves to one's notice, or occur to one's mind, at the time when the observation of them would be of the greatest assistance to the court. When there are strong grounds for suspicion, the most trivial appearances should be examined with great care.

In a case of murder, in which the body of the deceased was discovered in a mill-stream, there was only one slight ecchymosed depression in the fore part of the neck, as if from a finger. The surgeon suspected from this that the deceased had been strangled by the pressure of a hand on the neck. The marks of drowning in the body were wanting, and the medical suspicion of the real cause of death was afterwards confirmed by the confession of the criminal.

In cases of more severe violence, the chief inquiry is whether it has resulted from accident or from design.

In forming an opinion, a medical witness must give due weight to the accidents to which a body floating loosely in water may be exposed. Ecchymoses of considerable extent are sometimes seen on the body when it has been carried by a current against mechanical obstacles in a river or canal. Such bruises and ecchymoses may not be visible immediately after the removal of the body from the water, especially if removal takes place within a few minutes of death. Lacerations may be produced by the body being rubbed against sand or pebbles by the movement of the tide. If the deceased fell from a considerable height into the water, his body in falling might have struck against a rock or projection, and thus have sustained extensive marks of violence. A dead body taken out of a well often presents considerable marks of violence when the deceased has fallen in accidentally, or has thrown himself in intentionally. The presence of these marks should not lead to a hasty suspicion of murder. It is manifestly impossible to lay down any specific rules for coming to a decision in cases of this kind. In clearing up doubtful points, everything must depend on the acumen of the practitioner who is called upon to conduct an investigation. The first question which he has to determine is, whether the injuries on the body were produced before or after death (see " Wounds "). If after death, then they ought to be obviously of accidental origin. Accidental violence may sometimes be of so serious a nature that a practitioner may well doubt whether it does not indicate that the deceased had been treated with violence prior to submersion. In the case of a man who jumped from the parapet of Old London Bridge into the Thames, both arms were accidentally dislocated at the shoulders in the act of drowning. He had previously performed this exploit with impunity, but on the last occasion he sank and was drowned. Both his arms were found dislocated at the shoulder-joints, in consequence, it would seem, of his having fallen with his arms in the horizontal position, instead of placing them closely to his sides. The concussion of the arms on falling into the water had sufficed to produce the accident. Here, then, we have a proof that even the mechanical resistance offered by water alone may give rise to marks of violent injury on the person. Effusion of blood from this cause may take place into the cavities of the head, chest, or abdomen. Chevers examined the body of a sailor who fell into the water with his head downwards ; and it was found on inspection that there was an extravasation of blood in the head beneath the arachnoid membrane, and there was every reason to believe that extravasation had been produced by the fall

Fractures of bones may be accidental, as in diving into shallow water and striking a hard substance. Except in such circumstances, fractures are not often met with in the drowned as the result of accident.

This point was raised in *R.* v. *Kettleband*, where the prisoner was charged with the murder of a boy aged ten years.

Soon after he had been seen healthy and well, the deceased was found dead in a pond. At the inquest, no inspection of the body was required by the coroner, and the jury were directed to return a verdict of " Found drowned." An inspection was made subsequently, however. The neck was observed to be very loose, and on further examination, the tooth-like process of the second vertebra of the neck was found to be separated from the first (the atlas), through rupture of the ligaments. Three medical witnesses who gave evidence at the trial deposed that this displacement had caused death by compressing the spinal marrow ; that the injury had occurred during life ; and that it was not likely to have been caused by accident from a fall into the water, as there was no mark of a bruise about the head, and the pond was small, with a soft muddy bottom. All agreed that such an injury was not likely to have arisen from a blow or a fall in any circumstances, but it required for its production that the body should be fixed, and the head forcibly rotated on the trunk. It was in itself sufficient to account for immediate death, and it could not occur by accident after death from any other cause. Hence it was inferred—1st, that death could not have been caused by drowning; 2nd, that it had resulted from the compression of the spinal marrow by displacement of the second vertebra; and 3rd, that this injury must have been intentionally produced by some person prior to submersion.

Circumstances fixed the crime on the prisoner, and the jury returned a verdict of manslaughter.

It is an important question, whether fractures of the vertebræ of the neck can occur from accident alone, at or about the time of drowning. For a case in point, proving its possibility, *vide Lancet*, 1904, 2, 1076, where the case is reported of a boy who fractured his neck by collision with a fellow-bather.

In jumping from a bathing machine head first into water more shallow than he expected, a man fractured and displaced the vertebræ of the neck, and death ensued. A man threw himself into a river to bathe from a height of seven or eight feet, the water being only three feet deep. He rose to the surface, but fell back insensible. When he recovered consciousness, he said that he felt his hands touch the bottom of the river, but to save his head, drew it violently back, upon which he lost consciousness. He died in about ten hours, and on examination, the skin of the back of the neck was ecchymosed, the interspaces of the muscles were gorged, and the spinal canal was filled with blood. The body of the fifth vertebra of the neck was broken across about the middle of its depth, and the two pieces were completely separated from the lateral parts.

It is clear that such an injury may occur accidentally in cases in which one might not be prepared to expect it.

Violence of the nature of cutting may give rise to grave suspicion. The principal questions to be determined in such cases are: (1) Were the cuts made before or after death? This point will be found fully discussed under "Wounds." (2) Could they have been self-inflicted? This question has also been fully discussed, but it must be here noted that several cases are now on record where suicides have cut their throats deeply just before throwing themselves into deep water. As in all other cases of this nature, it is obvious that the longer the body has been in the water before inspection, the less easy will it be for the medical man to give definite evidence.

The Violence inflicted by Fishes, Rats, Molluscs, etc., on a body in the water is generally fairly easy to distinguish. The edges of the raw surface are more eroded than ragged or sloughy; there may be the actual marks of the teeth, or possibly even shell-fish *in situ*; but no doubt cases of great difficulty in this respect may arise, especially if the creatures attacked the spot where an open wound gave them easy access to the flesh; though this will in general tend more to obliterate homicidal or suicidal wounds than to exclude the action of animals.

Inasmuch as suicide may be attempted by more than one method, it is by no means rare to find poison in the stomach of those drowned. Stevenson met with a case in which there was every reason to believe that the man had taken a fatal dose of aconitine, and then had swum out to sea, where he was drowned; on the other hand, Tidy quotes a case where a woman administered arsenic to a friend, and upon finding its action too slow for her liking, pushed her victim into the water. Whereas the finding of poison in the stomach of a drowned person may not afford proof of intent in any direction, it requires explanation, and this must be sought in the attendant circumstances.

Firearm Wounds in the body of a drowned person may be homicidal or suicidal. They will require the same examination as if no question of drowning had arisen (*vide* p. 448 *et seq.*).

Drowning in Shallow Water always requires explanation. It is unsafe to assume that shallow water is insufficient to drown a person. The mere immersion of the mouth and nose in water or mud, not more than an inch or two in depth, is quite sufficient to produce all the phenomena of asphyxia. This may occur accidentally where persons are under the influence of alcohol or other drugs ; and where persons are helpless from other causes, as well as in the cases of infants, imbeciles and epileptics. There are also many well-authenticated cases in which suicide has thus been committed. It is easy to conceive of circumstances in which assailants or an assailant may hold a victim's head in such a position until life is extinct ; in the latter case, we might expect to find marks of violence on the body, or signs of a severe struggle if the person were conscious and capable of making a resistance. In any case of this nature, it is the duty of a medical man to note every possible circumstance, and if possible to visit the site where the body was found. He must then weigh his evidence of asphyxia and balance it up with all the surrounding circumstantial evidence. The following cases well illustrate the position :—

An inquest was held on the body of a gardener who was drowned in a brook. There were less than six inches of water in the stream. The man's face was on the mud at the bottom, and his hair was frozen. It was stated that his father committed suicide by hanging. The jury returned a verdict of accidental death.

A man was found dead with his face in some melted snow, and there were several severe contusions on his body. The evidence showed that, after a quarrel, he had left a neighbouring inn much intoxicated ; and it was rendered extremely probable that he had perished accidentally on his way home. There was no reason to suppose that he had been murdered.

A woman was charged with causing the death of a child by drowning it. The child was found dead, with its face in a basin of dirty water. The woman had placed the child in this position, and had then locked the door. The death of a child in these singular circumstances is, however, quite compatible with *accident.* A medical man attended a child, *æt.* 18 months, who was dying. On his arrival he found it dead : the skin was cold, and the countenance calm and pale, with the exception of a livid discoloration in the centre of each cheek. The eyelids, as well as the mouth, were half open. The pupils were widely dilated. A frothy mucus, tinged with blood, was escaping from the mouth and nostrils. The tongue was swollen and protruded. The mother of the infant, a respectable woman, gave the following account :—She was washing in one room while the child was in an adjoining room, the door between the rooms being kept open by a pail half full of water. She went out of the house for about two minutes, and on her return she found the child with its head downwards in the pail of water, the legs and part of the body hanging over the side of the pail. She snatched it out and tried to revive it, but without avail. There was no reason to doubt the truth of her statement, and at the inquest, the jury returned a verdict of accidental death. A man was found dead in a water-cistern in his house. He was partly dressed ; his head was downwards in the water, and his feet resting on the edge of the cistern. It was supposed that in reaching forward to the tap, he had lost his balance and fallen with his head first into the water, and was unable to extricate himself. The facts seemed to point to accident.

In the case of *R.* v. *Smith*, known as "the brides in the bath case," no less than three women were murdered by drowning in a bath. The murderer in each case had immersed the victim by lifting the legs up and pushing the head under water. In only one of the cases was there any signs of violence—that of Miss Lofty, in which there were three bruises on the arm.

A medical witness must not allow himself to be deceived respecting the cause of death on finding that the *whole* of the body had not been immersed, or that the clothes are not wet. In this form of murder, when the inspection is recent, the hair of the head will present the appearance of wetness, and some water, with or without weeds or other foreign matters, may be found in the ears, nostrils, throat, and lungs.

Ligatures on the Body. In considering the inferences to be drawn from the presence of ligatures on a body taken from the water, it is of great importance to determine in the first place whether death was caused by drowning or not. The presence of ligatures appears to offer strong *prima facie* evidence of homicide; but numerous cases are recorded in which suicides have tied their limbs together before throwing themselves into water, probably to make sure of death.

In one case of suicide, the hands and legs of the deceased were found tied. Around the wrists there was a slip-knot by which the cord could be drawn tightly. The legs were also tied in front.

Where the marks bear the evidence of violent constriction, especially on *both wrists*, or on the fore part of the neck, the presumption of murder becomes strong.

The nature of the evidence to be given will obviously depend upon the position, the tightness and the nature of the ligatures, as well as the position of the knots (*vide* "Strangulation," p. 562). If the limbs only are tied, an effort should be made to ascertain whether they are tied in a way in which the victim could have tied them himself. Too much reliance cannot be placed upon evidence of this nature, inasmuch as a cunning murderer or a suicide might succeed in completely deceiving an experienced medical witness. The presence of a ligature, almost certainly precludes the possibility of accident (unless overwhelming circumstantial evidence of accident is available).

Weights attached to Body. If a body is taken out of water with heavy weights attached to it, the question of *accident*, as in the former case, is removed. It must be either homicide or suicide, and doubtless many would be inclined to suspect that it was a case of murder. Several instances have, however, occurred in which persons have committed suicide by drowning, and heavy weights have been found attached to their feet and hands, or in or about the clothing. Much the same remarks apply here as in the case of ligatures above; the nature of the weights, how they are attached to the body, *i.e.*, by ligature or fixed in the clothing, etc., each and all of such findings, if properly handled, may throw much light on the case. The circumstantial evidence may be of great importance.

The age of the Deceased has some bearing on the question of accident *v.* suicide or homicide, and also on suicide *v.* homicide. The earliest age at which a person is reported to have committed suicide by drowning is that of a boy of seven.

Some of the more important questions to which a medical witness may fairly be expected to give more or less positive answers are :—

(1) Was drowning the sole cause of death ?

(2). If not, what was the cause of death ?

(3) If wounded, were the wounds (*a*) sufficient by themselves to cause death ; (*b*) inflicted before or after death ; (*c*) self-inflicted or otherwise ?

(4) If tied up, could the tying have been done by the deceased, or must it have been done by others ?

(5) Similarly, if weighted, could the weights have been attached by the deceased ?

STRANGULATION

Definition of Strangulation.
Symptoms of Strangulation.
Cause of Death in Strangulation.
Treatment of the Apparently Strangled.
Post-mortem Appearances in the Strangled.
Was Death due to Strangulation ?
Was it Accidental ?
Was it Suicidal or Homicidal ?

In this section we shall consider strangulation by means of a ligature and manual strangulation, commonly known as throttling, together. Hanging and strangulation were formerly treated together, but they are now rightly separated. In hanging, the phenomena of asphyxia take place in consequence of the *suspension* of the body, while in strangulation asphyxia may be induced not only by the *constriction* produced by a ligature round the neck independently of suspension, but by the simple application of *pressure* (throttling), through the fingers or otherwise, on the windpipe. While the proof of death from hanging leads to a strong presumption of suicide, the proof of death from strangulation is *prima facie* evidence of murder.

Definition of Strangulation

As noted above, strangulation may be defined as an act of violence whereby constriction is applied to the neck (air-passages and blood vessels) by some means other than the weight of the victim's body.

Symptoms of Strangulation

So far as these can be said to exist they are described under " Symptoms of Hanging " (*q.v.*), for in all experiments on that subject the *symptoms* were produced by violence, which was pure strangulation.

When it is remembered that a person can voluntarily hold his breath for, say, at least thirty seconds, it is very remarkable that a sudden and violent compression of the windpipe should render a person powerless to call for assistance or to give alarm, and cause almost immediate insensibility and death. This it undoubtedly does, as is shown by the old criminal practice of garrotting, and also in many of the cases below, and it seems to prove that death is not a matter of asphyxia alone.

With incomplete closure of the windpipe, convulsive movements sometimes occur. Occasionally there has been bleeding from the ears, nostrils, mouth, and throat. The face usually becomes in the first instance black. The hands are clenched As a rule, insensibility is so rapid that there is no pain.

Cause of Death in Strangulation

In hanging we shall see that there is probably more than one method by which death may occur. In strangulation, too, though asphyxia may be the main cause of death, there is no doubt that pressure on the carotid body causing inhibition of the action of the heart and pressure on the carotid artery, causing anaemia of the brain, are factors of importance.

It is probable that human beings die more quickly than animals, especially from the effects of manual strangulation.

Treatment of the Strangled

Inasmuch as strangulation is almost invariably homicidal, or accidental out of reach of assistance, it is but very rarely that treatment can be considered ; should an opportunity for it occur, the same principles must be carried out as in a case of hanging. Artificial respiration must be started at once and stimulants injected.

If the body be cold, hot bottles, accompanied by rubbing, and venesection should be adopted. The subsequent treatment must depend on whether adventitious disease, or the local injuries to the neck and other parts, or the effects of shock, etc., have to be combated. It may be necessary to perform tracheotomy or intubation.

If no injury has occurred to the neck, there is a good chance of survival, provided treatment be adopted within a short period.

The after-effects of strangulation—that is, supposing the first effects be recovered from—are often serious. In addition to convulsions and an extreme swelling of the neck, lower part of the face, and upper part of the chest, there may be pulmonary and laryngeal troubles, together with the formation of abscesses, whilst death may occur unexpectedly and at a period somewhat remote from the attack, probably as the result of damage to the brain by interference with its circulation.

Post-mortem Appearances in the Strangled

These may be divided into—

The general external appearances.
The special dissection of the neck.
The general internal appearances.

General External Appearances. The face may be livid and swollen, the eyes wide open, prominent, and congested, the pupils are dilated, the tongue swollen, dark-coloured and protruded ; it is sometimes bitten by the teeth, and a bloody froth escapes from the mouth and nostrils. These external signs of violent death may, however, be absent, with nothing but a slight dusky or leaden hue about the lips, or even a pallid appearance. Tardieu's spots are sometimes to be seen beneath the skin of face, neck and chest, and beneath the conjunctiva. Blood may have escaped from the nose and mouth even in large quantities, as in *R.* v. *Millas.*

The prisoner had murdered one Huelin and his housekeeper. After having packed the body of the housekeeper in a box, he requested a carrier to place a cord around the box. The carrier observed that fluid blood was oozing from the box, and that there was a large stain of blood on the floor beneath. When the box was opened, the body of the woman was found inside. There was a cord tightly tied around the neck, and blood had escaped from the mouth and nose, and had run down the side of the box. The woman had been strangled, and such force had been used in the tightening of the cord around the neck as to lead to a copious effusion of blood from the mouth and nose.

In cases of asphyxia, as it has been elsewhere stated, the blood, owing to its fluidity, continues to flow for some time after death from any lacerated wound or blood vessel. In some instances of strangulation, blood has escaped from one or both ears during the act; but this is not a usual appearance. In two well-marked cases, the constriction was carried to a great degree, but there was no bleeding from the ears. Geoghegan met with one instance of *suicidal* strangulation, which he examined; the constriction had been produced by a riband, and the violence applied was sufficient to produce bleeding from one ear: on dissection, this was found to have resulted from a rupture of the membrane of the drum of the ear. There was no froth at the mouth or nostrils, and scarcely any lividity or swelling of the face. It was further observed that the mark on the neck, which was deep, almost disappeared on the removal of the ligature. Wilde met with a case in which rupture of the membrane of the drum of the ear, with effusion of blood, was caused by strangulation. Bleeding from the ears, as a result of rupture of this membrane, must, however, be regarded as an exceptional appearance. The general lividity of the body, with the clenching of the hands and swelling and protrusion of the tongue between the lips, are generally more marked in strangulation than in hanging. A thin mucous froth tinged with blood is occasionally found in the air-passages in both cases. The involuntary discharge of fæces, urine, and seminal fluid, described as one of the characters of death by hanging, may equally occur in death from strangulation. No importance can be attached to this as a sign of death from asphyxia in any form. It frequently occurs in sudden and violent death from any causes, and there are many instances of death from asphyxia in which it is not observed.

Dissection of the Neck. In the act of strangulation a much greater degree of violence is commonly employed than is necessary to cause death; and hence the marks produced on the skin of the neck will be, generally speaking, much more evident than in hanging, where the mere weight of the body is the medium by which the tissues of the neck are compressed.

If much force has been used in producing the constriction, the windpipe, with the muscles and vessels in the fore part of the neck, may be found cut or lacerated, the hyoid bone is sometimes fractured, and even the vertebræ of the neck may be damaged.

The mark on the neck when a ligature has been used, is commonly described as a depression, corresponding in its characters to the form and thickness of the ligature and the mode in which it has been secured. Too much importance must not be attached to this supposed correspondence when the ligature is not forthcoming. In the case of the boy mentioned below, the mark around the neck presented the appearance which might be expected from the use of a narrow cord. In that case, however, a soft silk handkerchief was the means of constriction ; and a peculiar narrowness of the mark on one side was owing to the great tightness with which it had been drawn. The mark or impression produced by a ligature is generally circular, from the mode in which the pressure is produced. It may be situated at any part of the neck, but it is more commonly on the windpipe below the larynx, or across the thyroid cartilages of the larynx, contrasting with the position above the larynx in hanging. In *manual strangulation* the marks of bruising and ecchymosis will be in the front of the neck, chiefly about the larynx and below it. The circular direction of a mark produced by the ligature is not an absolute indication that strangulation has taken place without suspension of the body, since instances have been related where a circular mark has been observed in hanging ; and it is possible that some degree of obliquity may occasionally exist in the course of the depression produced by a ligature in strangulation. A medical witness ought, therefore, to weigh all the facts connected with the position of the body, and the nature and direction of the ligature, before he forms an opinion, from the appearances presented by the mark on the neck, whether the person has been strangled or not. Greater importance is to be attached to the lividity, ecchymosis, and abrasion of the skin in the course of the ligature than to the circularity or obliquity of the depression produced by it. When a living person is strangled by means of a cord, it is scarcely possible to avoid producing on the neck marks of severe injury, the existence of which indicates the violent manner in which death was caused.

On the other hand, a person may be strangled, and yet the ligature, in consequence of its being soft and of a yielding nature, may not cause a perceptible depression or ecchymosis—scarcely anything more than a slight depression of the skin. If we except cases of suicide, such a condition must be rare, because assailants usually produce a much more violent constriction of the neck than is necessary to ensure the death of a person. Among the occasional appearances of violent strangulation may be mentioned injury to the windpipe and the muscles of the neck around it.

Fracture of the hyoid bone is extremely rare except in cases of manual strangulation, in which it is relatively common.

One case, in which the rings of the windpipe were split as a result of pressure, was met by Inman. Several instances of laceration and rupture of the windpipe are quoted by Chevers. In one instance the ossified thyroid cartilage had been broken and forced inwards, causing suffocation. In *R.* v. *O'Brien*, a case of alleged murder by strangulation, the cartilage of the windpipe was broken ; and in the case of Pinckard, the windpipe was broken longitudinally.

General Internal Appearances. *The Lungs.* These organs show very marked changes. Intense venous congestion, with numerous petechial hæmorrhages and numerous spots and patches where vessels have given way, are found in the majority of cases. In addition, froth, more or less bloodstained, will be found in the bronchi. Though this is the usual picture, cases in which death occurs with great rapdity do not show the same degree of congestion.

Microscopic sections show areas of hæmorrhage into the lung tissues, rupture of the alveolar walls in some places and collapse in others.

The heart presents no uniform condition ; but the right side is usually full of dark fluid blood. The brain is occasionally congested. In one instance blood was found effused on the brain. This is an unusual appearance in adults, but is more common in newly born children.

The abdominal viscera, liver, kidneys, spleen, etc., are usually deeply congested, and, especially in young persons, may show petechial ecchymoses.

The medico-legal questions which arise in a case of strangulation are similar to those which arise in a case of hanging. Thus, in examining the body of a person suspected to have been strangled, the following questions arise :—

Was death due to strangulation, or was the ligature placed around the neck after death ?

Was it accidental, suicidal, or homicidal ?

Was Death due to Strangulation ?

The **appearances of asphyxial death** found in strangled bodies have been noted above, *viz.*, intense venous congestion in general, hæmorrhages into the substance of the lung and into mucous membranes, punctate petechiæ in the skin, prominence of the eyes, protrusion of the tongue, or its pressure against the teeth and bloody froth and mucus in the trachea. Now, considering that circulation ceases with life, it is utterly impossible that a ligature placed round the neck after death could by any means whatever produce these appearances. Hence the presence of these signs strongly suggests that death was due to asphyxia.

Evidence of **violent compression of the neck** during life is obtained from the presence of ecchymoses about the depression on the neck caused by the ligature, hæmorrhage at some distance from the depression, and swelling and lividity of the face. These are phenomena which cannot be simulated in a dead body by the application of any degree of violence. When the constriction is produced within a few minutes after death, a depression results, but it is improbable that there should be any lividity or swelling of the countenance. The experiments of Casper gave the following result : that he could not produce on a dead body anything at all resembling an *ante-mortem* strangulation mark.

It is difficult to conceive in what circumstances an attempt to simulate strangulation in a recently dead body could be made, unless for the purpose of throwing suspicion upon an innocent person connected with the deceased. When an individual has been murdered, it is not likely that the murderer, in order to conceal his crime, would attempt to produce the appearances of strangulation on the body after death ; for strangulation is in most cases the result of homicide, and is rarely an act of suicide.

In the absence of ecchymosis in the neck, it will be difficult to form an opinion, unless from circumstantial evidence. It must be remembered, however, that there may not always be an ecchymosed *circle* ; for a person may be strangled by the application of pressure to the neck through the medium of the fingers, or of any hard or resisting substance. The ecchymosis in such a case will be in detached *spots* or *patches*, and usually the semilunar indentations of the nails can be observed. In the absence of all marks of violence round the neck, we should be cautious in giving an opinion which may affect the life of an accused party ; for it is not probable that homicidal strangulation could be accomplished without the production of some appearances of violence on the skin over the larynx or windpipe. It is doubtful whether strangulation can ever take place without some mark being found on the neck indicative of the means used, but there is a bare possibility that death may be caused in this manner, without leaving any appreciable trace of violence. Suicides and murderers generally employ much more violence than is necessary for the purpose of taking life. If a soft and elastic band were applied to the neck with a gradually regulated force, it might be possible that death from strangulation would result without there being any external sign indicating the cause of death. Thugs, and other Indian robbers, were thus accustomed to kill their victims with great dexterity.

The medical witness should, however, be prepared to consider whether, in the absence of any mark, death might not have resulted from another cause. There is nothing to justify a witness in stating that death has resulted from strangulation if there should be no appearance of lividity, ecchymosis, or other violence about the neck or face of the deceased. The state of the countenance alone will not warrant the expression of an opinion, for there are many kinds of death in which the features may become livid and distorted from causes totally unconnected with the application of external violence to the throat, unless accompanied by other well-marked signs of this mode of death. So, again, the eyes and tongue may be protruded as a result of putrefactive changes. When there are signs of mechanical violence applied to the neck, such as fracture of the larynx or windpipe or hyoid bone, accompanied by laceration of the muscles, and a visible depression, such as might be produced by a cord, a ligature, or manual pressure, a medical opinion may be fairly given in spite of putrefaction. But when, in a putrefied body, indistinct marks on the neck or patches of discoloration are relied upon as evidence of homicide, there is a great risk of a serious mistake. See on this question *R.* v. *Byrne* (p. 243), and of *R. Mahaig* (p. 245).

In cases of alleged drowning it is sometimes the practice to ask a medical witness how far his opinion of the cause of death has been influenced by the discovery of the dead body in or near the water. In cases of alleged strangulation, a similar question may be put in reference to the discovery of a rope or ligature around the neck of the deceased, or in the room in which the dead body is found. A medical opinion should rest upon the clear and obvious effects produced on the neck and structures below the skin, and not upon the mere presence of a cord or ligature. This might, for a malicious purpose, have been put around the neck of a dead body or near it. A medical witness should be able to prove the fact of strangulation without the production of a rope as easily as the fact of stabbing without the production of the weapon used by the assailant.

The ligature or cord should always be examined for the presence of blood, hair, or other suspicious substances.

Was it Accidental, Suicidal or Homicidal ?

Accidental Strangulation. As a general rule, cases of accidental strangulation present no difficulty to a medical jurist, provided the relations of the body to surrounding objects and the compressing force have not been disturbed. Should the body have been removed from the place in which it was first discovered, or the ligature have been removed, we can only establish a presumption of accident from the description given. Accidental strangulation, like accidental hanging, may be looked upon as rare. When the body is not suspended, it is commonly more in the power of a person to assist himself, and escape from the constriction; hence accidental strangulation is less frequent than accidental hanging. A few instances of accidental strangulation are on record.

In one such case, the subject was a boy, who was accustomed to move about with a heavy weight suspended by a string round his neck. One day he was found dead in a chair: the weight appeared to have slipped, and to have drawn the cord tightly round the fore part of his neck. A girl was accidentally strangled in the following manner: She was employed in carrying fish in a basket on her back, supported by a leathern strap passing round the front of her neck, above her shoulders. She was found dead, sitting on a stone wall; the basket had slipped off, probably while she was resting, and had thus raised the strap, which had firmly compressed the windpipe. A similar case is recorded by Watson ("On Homicide"). A boy, *æt.* 14, while working in a factory, was caught by a silk necktie in the band of an engine, and his neck was by this drawn down against one of the revolving shafts. The silk handkerchief being knotted and tightly twisted round his neck, his throat was firmly compressed for about one minute. The tie was then cut. As a result of the strangulation, he became black in the face, and blood escaped from his mouth and ears. He was insensible for six or seven minutes after the ligature had been removed. He then revived and was able to speak, but could not hold up his head. He was sensible when brought to the hospital soon afterwards: his face was pale, his lips livid, his eyes suffused, and the conjuctivæ injected. He breathed without difficulty, and complained of pain only when he moved his head. There was a deep circular depression round his neck over the windpipe, and the skin was much lacerated and bruised. The mark was about threequarters of an inch in width on the left side. The circumference of the neck was twelve inches, while the inner circumference of the handkerchief which compressed the neck was only eight inches. From this difference it will be perceived that the neck sustained a very strong compression, which accounts for the flow of blood from the mouth and ears. The boy at the time of the accident felt no pain: he had a sense of choking, and then became insensible. For at least *one minute* no air reached the lungs. He recovered, and left the hospital in about eighteen days.

The facts of this case confirm the observations of Casper and others on the rapidity with which insensibility ensues from compression of the windpipe.

When a charge of murder by strangulation is brought, an attempt is not infrequently made to show the probability that the deceased, while in a state of intoxication, might have fallen, and have become accidentally strangled, either by a tight scarf or tie. When there is pressure on the windpipe, a person will usually make frantic efforts to free his neck, and thus may inflict injuries on his throat which may lead to a suspicion of throttling. The possibility of other more probable causes of death must not be overlooked, and we must never abandon a probability for a mere possibility.

The umbilical cord may be so twisted around a new-born baby's neck as to cause accidental strangulation. If such a case aroused suspicion of homicide, marks of violence would be the chief evidence, as accidental strangulation by this means leaves no bruises or other marks except possibly a slightly indented non-excoriated mark.

The following is a curious case of accidental strangulation.

The deceased was subject to epileptic fits, and when the husband returned home he found his wife dead on the floor with her head wedged in between the seat and the rail of a chair. A medical witness said that death was caused by strangulation from falling whilst in a fit in the position described.

Suicide or Homicide ? There is as a rule less difficulty in answering this question in cases of strangulation than in alleged hanging, owing to the greater difficulty of a murderer being able to simulate a suicide. For all that it may now and again be very difficult to decide, and we must consider the various points that may help us in forming an opinion.

Statistics.
Inherent possibility of suicide.
Bodily infirmity as an obstacle.
Is there any other cause of death ?
Marks of violence elsewhere than on the neck.
Signs of a struggle.
Marks on the neck.
Nature of the ligature and its method of application.
Position of body.
Circumstantial evidence.
Cases of homicidal strangulation.
Alleged strangulation.

Statistics. According to the Report of the Registrar-General for 1940, no persons met their death from accidental strangulation.

Inherent Possibility of Suicide. This method of suicide must be regarded as of rare occurrence, but there is no doubt that it is quite possible to strangle oneself by means of a ligature. It is otherwise in throttling by the hand however, for all power is lost soon after the compression of the windpipe is commenced, and with the loss of consciousness the grip of the fingers must relax. When a person, determined on suicide, allows the windpipe to be compressed by leaning with the whole weight of his body on a cord passed round his neck and attached to a fixed point, he may die in this manner almost as readily as if he had hanged himself ; for insensibility and death will soon supervene.

Similarly a cord may be tied around the neck and twisted tightly by means of a stick used as a lever. Other cases have been known in which a cord has been wound several times around the neck and actually tied.

Bodily Infirmity as an Obstacle to Suicide. There may be disease, such as paralysis or deformity in one or both of the arms, which may render it impossible for a person to tie a ligature around his own neck. The only caution here to be guarded against is that we do not push this doctrine of incapability too far. When there is a fixed resolution, many apparent impossibilities may be overcome by a person bent on suicide. The following case is instructive :—

A middle-aged woman was brought into the Hotel Dieu, suffering from insanity. Soon after her admission she killed herself by strangulation. The nurse, in going round the ward, saw her lying at the side of the bed with her head hanging out. Upon examination it was found that she was dead, and that there was a silk handkerchief around her neck. The handkerchief had been carried twice around the neck and then tied in front. The eyes and eyelids were very reddened and swollen.

The marks of the ligature around the neck were deep, ecchymosed and partially excoriated: the brain, though a little congested, was healthy. The other organs presented no appearance calling for notice.

It is worthy of remark that in this instance, in which there could be no doubt of suicidal strangulation, the deceased had lost four fingers of her right hand; nevertheless, she managed to tie the handkerchief around her neck with great firmness and dexterity. If her body had been found in a suspicious place, a plausible opinion of homicidal strangulation might have been formed from the maimed condition of the hand. This case, then, will serve to convey a proper caution in drawing inferences as to acts which a person suffering from some corporeal infirmity are capable of performing when he makes an attempt on his own life.

Is there any other Cause of Death? All marks of violence on the body of a supposedly strangled person should be accurately noted, as the facts respecting them, however slight, are material. A medical witness should be able to state whether they were inflicted before or after death; if before, whether they were sufficient to account for death, or whether they were such as to be explicable on the supposition of an accidental, suicidal, or homicidal origin. It should be observed whether there are any morbid changes, sufficient to account for death, in any of the three great cavities of the body, as this kind of evidence may be essential. In the case of females, whether children or adults, the practitioner should not neglect to examine the sexual organs, so as to ascertain whether there are any marks of violation or signs of pregnancy. Cases have occurred in which rape has been perpetrated and strangulation resorted to for the purpose of concealing the crime, or in accomplishing the criminal act.

R. v. *Gibbons*,[1] presented some features of interest in this connection. A woman was charged with the murder of her illegitimate son, *æt.* 8. The child was alive and well at about 4.30 p.m., at which time he was taking tea with his mother; a little before 8 p.m. he was found dead in bed lying on his back, with his arms across the lower part of his chest. A silk handkerchief was tied tightly around his neck, and the bed-clothes were a little turned off him. There was a mark or depression round the neck where the handkerchief had been tied, but no ecchymosis beneath. The brain and its membranes were much, the lungs but slightly, congested; the stomach contained some partly digested food; the mucous membrane is stated to have been found considerably inflamed, and the inflammation extended to the upper part of the small intestines.

One medical witness said that, in view of the fact that the handkerchief was found around the neck and of the position of the body, he was of opinion that death was caused by violence (strangulation); and he did not think that the boy could have strangled himself. If he had tied the handkerchief tightly enough to produce strangulation, he could not have returned his hands to the position in which they were found. Another medical witness considered that deceased had died from poison. He formed this conclusion from the extensive inflammation of the stomach and intestines, and from the absence of any other cause sufficient to account for death. He did not think the congestion of the brain was sufficient to cause this, nor did he think that the deceased had died from strangulation. There was an absence of the usual mark, and the face was pallid; the congestion of the lungs was slight, and there was no blood in the right cavities of the heart. A chemist stated that he had examined the contents of the stomach, and found no mineral poison there; the inflammation of the stomach might have arisen from poison or from natural causes. As the medical evidence failed to prove that the deceased had died from violence, the prisoner was acquitted. It is not at all probable that in this case the appearances in the stomach were the result of inflammation from irritant poison. Any irritant, mineral or vegetable, which would have destroyed life in three and a half hours, without causing vomiting and purging, would have been found in the stomach. The partly digested meal taken at 4.30 p.m., when the boy was seen healthy and well, was there found unmixed with any poison. How, and when, was the silk handkerchief tied round the neck? It was not the result of accident, and this kind of suicide could not be suspected in so young a child. The attitude in which the body was found and the age of the child were adverse to the possibility of suicide. The handkerchief was not tied round the neck after death—there could be no motive for such an act; it must have been tied while the child was living. The absence of any ecchymosis in the course of the ligature is not opposed to this view. The state of the brain appeared to show death from apoplexy as a result of interruption of the cerebral circulation by the ligature. The redness of the stomach was probably attributable to congestion, and not to inflammation, and may have been caused by the process of digestion going on at the time of death; or it may have been the result of congestion, as observed in the bodies of executed criminals. In this case, although evidence was more circumstantial than medical, there seems little doubt that the child was strangled.

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[1] *R.* v. *Gibbons*, Northampton Lent Ass., 1853.

Marks of Violence elsewhere than on the Neck. It may be inquired whether marks of violence on the body, or blood stains on the clothes, the furniture, or in the apartment, do not afford strong evidence of *homicidal* strangulation. The answer is—if the marks of violence are such that they could not have arisen from any accident before death, or that they could not have been self-inflicted, they afford the strongest evidence of murder. But the cases wherein so positive an answer can be returned are exceptions to the rule. It is not always possible to distinguish *accidental* or *self-inflicted* from homicidal violence; and one should always consider the probability of accident, or of previous attempts at suicide being the cause of those personal injuries which may be found on a strangled body.

The throat may be cut, there may be a deep-seated stab or gun-shot wound, involving some of the important organs of the body, or poison may be found in the stomach; but in a purely medical point of view, how are we to know that the deceased did not actually make the marks, inflict the wounds, or take the poison before he succeeded in strangling himself? In the Sections on "Drowning" and "Hanging," there are examples of what a suicide can do when he is determined to kill himself. Wounds and personal injuries often create serious difficulties to a medical witness who is called upon to explain them. Before bringing a charge of murder by strangulation based upon the existence of marks or appearances found on a dead body, care should be taken to ascertain that such marks or appearances were caused only by violence. Even if marks indicative of strangulation are discovered, the question arises whether they may not have been produced upon himself by the deceased in an attempt at suicide. If the body of a dead person is allowed to cool with a handkerchief, band, or tightly fitting collar round the neck, a mark resembling that of strangulation may be produced. (See *R*. v. *Byrne* and *R*. v. *Mahaig* (pp. 243 and 245).

Signs of a Struggle, etc. In directing attention to the circumstantial evidence, it was suggested that the clothing of the deceased might be torn or disarranged, a fact indicative that a struggle had taken place, and, *cœteris paribus*, incompatible with suicide. Evidence of murder (as in Pinckard's case), may be obtained by finding a smooth and undisturbed state of the clothing, as well as attitude of the body. In fact, whoever attempts to simulate suicide under such a form of murder generally fails in his object. The assassin either does too little, or he does too much.

The woman who committed the murder in Pinckard's case had been a nurse in an infirmary, and was accustomed to lay out dead bodies. After the murder she appears, unthinkingly, to have acted in accordance with her professional practice, by smoothing the clothes under the body, placing the legs at full length, the arms out straight by the side, and the hands open and laid out. Such a condition of the body was quite inconsistent with suicide, in view of the amount of violence which must have attended the act of strangulation.

In the case of Drory, the criminal had attempted to make the case look like a suicide by placing the lower end of the rope near the hand of the deceased: but he selected the *left* hand, whereas the deceased was right-handed, and he did not leave enough rope free from the neck for either hand to grasp in order to produce the violent constriction of the neck caused by the two inner coils.

Both of these criminals confessed their guilt before execution.

Whereas suicidal strangulation may be effected under unexpected circumstances, in a case of murder by strangulation it would not be easy to simulate suicide: it would at any rate require great skill and premeditation on the part of a murderer so to dispose the body of his victim, or to place it in such a relation to surrounding objects, as to render a suspicion of suicide even probable.

Homicidal strangulation may be perpetrated on the weak and infirm without causing any noise or creating alarm. In the first place, if the throat is at once seized and firmly compressed, no cry can be made, nor any noise produced to attract the attention of those who are near.

An aged woman was strangled in her shop by an apprentice in so short a time and with such ease that her husband, who was separated from her only by a slight partition, heard no noise or disturbance during the murder.

Marks on the Neck of the Ligature or of other Violence. *Finger-nails.* In cases where the marks of fingers or finger-nails are present, the presumption is in favour of homicide. A suicide is not likely to strangle himself in any manner other than by a ligature applied circularly. In cases in which strangulation has resulted from a compression of the wind-pipe by the fingers (throttling), and where there are ecchymosed marks indicative of direct manual violence, there is the strongest presumptive evidence of murder; for neither accident nor suicide could be urged as affording a satisfactory explanation of such marks.

It is doubtful whether a person could strangle himself by the mere application of the fingers to the windpipe: the discovery of such marks *only*, as would indicate this kind of strangulation, therefore, renders suicide in the highest degree improbable. But such marks may sometimes be attributable to a fall by the deceased while his hand was passively applied to his neck. The inference will be drawn that the marks were accidentally caused by the pressure of his own fingers. This is an improbable mode of accounting for the production of ecchymosis or excoriation of the skin in front of the neck. If, besides these marks of fingers there is a circular mark with a ligature still around the neck, the presumption of murder becomes very strong. A person might at first try to strangle himself with his fingers, and upon failure, might afterwards use a cord. But the degree to which the coincidental impressions exist will usually remove all doubts. A murder was once committed in the manner mentioned.

A man was found strangled on board a ship. Besides the mark of a rope drawn tightly around the neck, there were distinct impressions of nails and fingers in front of the throat. An investigation took place, and the result proved—as, indeed, this state of the neck rendered it almost certain—that the deceased had been murdered. One of the murderers afterwards confessed that they had first strangled him with their hands, and then had drawn the rope about his neck, to make sure that he died.

Finger-nail marks might be self-inflicted in a struggle, which again suggests homicide, although it must be remembered that an epileptic (or indeed any one), might thus injure the throat in an attempt to escape accidental strangulation by a collar.

There may be *several marks* on the neck, which may be evidence that the person had tried more than once to strangle himself.

Fracture of Larynx and Deep Ecchymoses. In homicidal strangulation, from the unnecessary violence used, we may expect to find the skin much ecchymosed, lacerated, or excoriated, and the deep-seated parts, such as the muscles and vessels, more or less bruised or lacerated. The hyoid bone, larynx or trachea may show signs of pressure. Such a degree of violence is not to be expected in *suicidal* strangulation.

In the following case, the marks of injury to the neck clearly established homicidal strangulation :—

The dead body of a man, *æt.* 70, was found lying in a potato-field. The deceased had gone to gather potatoes for his servant, who was digging. On its being known to their neighbours that the body had been found in the field, suspicions were aroused that his death had resulted from violence. On opening the skull, a large quantity of dark fluid blood escaped, the membranes of the brain were greatly congested, the sinuses or large veins were gorged with blood, and the brain itself was also congested. Several clots of blood were observed in the lateral ventricles, and some on the surface of the brain. The lungs were filled with dark fluid blood, the air-cells were ruptured, and there was considerable emphysema. The right side of the heart was distended with dark blood. There was nothing remarkable in the abdominal viscera, but the lining membrane of the stomach, which was about half filled with potatoes, was congested. On the neck, over the left side of the thyroid cartilage, there was a slight mark of a crescentic form, with a corresponding though slighter mark on the opposite side. There was a large quantity of coagulated blood immediately beneath the marks, and in the substance of the muscles. On removing this, the left side of the cartilage, which was ossified, was found much depressed, and traversed by a fracture nearly an inch in length.

From the general appearances presented by the body, together with the injury to the thyroid cartilage, an opinion was given that death had arisen from manual strangulation—and, from the particular form of the external marks over the neck, *by a left hand.* The deceased and the servant were on bad terms, the deceased having threatened to dismiss the servant, and before they had gone to dig potatoes, the servant said he would be revenged on his master. The servant was committed for trial. The prisoner was asked to throw a stone, in order to ascertain whether he was left-handed. He did so with the *left hand.* At the trial the sister of the prisoner swore that she saw her brother strangling the old man, and several witnesses proved that he had maltreated the deceased on many previous occasions. The jury, however, acquitted him.

In *R.* v. *Waller*,[1] a medical man was throttled by three men, one of whom placed his left hand over the mouth of his victim, and with the right compressed the throat. When found within five minutes of the attack, the deceased was alive, but died almost immediately after. The *post-mortem* examination showed only a slight mark on the neck, crescentic in form, with the concavity upwards, a little to the right of the median line, and just below the cricoid cartilage. It appeared as if made by a thumb- or finger-nail. There were no other indications of violence. The scalp showed numerous minute ecchymoses, and the features were of a peculiar leaden, livid hue. There was much blood extravasated along the larynx and trachea. The hyoid bone was fractured on the right, close behind the lesser cornu. The thyroid cartilage was fractured vertically from the notch backwards and downwards to the lower border, the right cornu was knocked off, and there was an almost corresponding fracture on the left. The cricoid cartilage was also broken on the right, the two ends overriding one another. The lungs were emphysematous and showed a silvery appearance on the surface. The air-cells contained blood, and there was an apoplectic nodule in the left lung. The heart had both its ventricles nearly empty of blood, and the auricles showed no unusual distension.

In *R.* v. *Pinckard*, the deceased was found in a sitting posture on the floor in a corner of her room, with a narrow tape around her neck, hung loosely and singly over a small brass hook about three feet above her head. Her clothes were placed smoothly under her, and her hands were open and stretched out by her side. There was a severe bruise over the right eye, and there were marks of blood on the tape, as well as on the floor and wall of the room at a distance from the body. There was a stain of fresh blood on the knot of the tape where it passed over the hook, and there was no blood on the hands of the deceased. The windpipe for about an inch and a half was lacerated longitudinally in its rings, and there was a deep circular mark around the neck in the course of the doubled tape, as if either from great pressure applied by some person or from the weight of the suspended body.

The latter hypothesis, so far as the tape around the neck was concerned, was untenable. The body of the deceased did not weigh probably less than 120 pounds, whereas the tape found around her neck broke under a weight of 49 pounds; hence the deceased could not have been freely suspended by it. Apart from this, the injuries to the parts about the neck, including the longitudinal fracture of the windpipe, were not such as the tape could have produced as a result of partial suspension in the position in which the deceased's body was found. The noose had been so placed that the greatest pressure was on the back of the neck, and the least in front, where the greatest amount of mechanical injury was caused. The deceased had been strangled, probably by manual violence in the first instance, and afterwards by the use of a ligature drawn tightly by the hand. The body was then looped up. These facts, taken in connection with the smooth arrangement of the clothes, the severe marks of violence on the body (inexplicable on the hypothesis of suicide), and the marks of blood and of struggling in the room, proved that there had been homicide; and the crime was brought home to the prisoner by a series of moral and circumstantial proofs inconsistent with her innocence.

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[1] *R.* v. *Waller and others* C. C. C., November, 1892.

False marks on neck. A caution must be entered here to ascertain whether the mark *is* that of a cord On the dead bodies of infants and children, in whom the neck is short, a mark is occasionally seen which arises from the bending of the head; and in short-necked persons, a similar mark or depression has been noticed after death, in front of the neck. If the collar band of the shirt is tight it may produce a depression which may engender suspicion. These marks are then rendered more prominent by their assuming a livid appearance. They might, at first, be mistaken for marks produced by a ligature in attempted strangulation. In one case a death from apoplexy was attributed to homicidal strangulation from a cadaveric change of this kind.

Mark in a Burnt Body. The mark on the neck has furnished evidence of this mode of death, even in circumstances in which it might be supposed all evidence would be destroyed. Schuppel describes a case in which he was able to verify the fact of strangulation after the burning of the body.

A fire took place in a cottage in which there were at the time a man and his wife with a stepson (*æt.* 10) and a new-born infant. The dead bodies of his wife and stepson were discovered much burnt, and the carbonised remains were collected and buried in one coffin. A suspicion of incendiarism and murder arose, and the bodies were exhumed thirteen days after the burial, and submitted to the examination of Schuppel. The body of the wife was so completely destroyed by fire that no satisfactory medical evidence could be obtained from it The parts not entirely burnt were much putrefied in both corpses. On examining the burnt remains of the boy, there was a horizontal mark or depression encircling the greater part of the neck, about one-quarter of an inch wide, and presenting a smooth surface quite distinct from the broken, blistered and carbonised skin above and below it. The width of the mark in the middle of the neck (the nape) where it was most superficial, was about a quarter of an inch; on each side of the neck where the pressure had been greatest, it was three-fifths of an inch. The depth of the mark at the sides was one-eighth of an inch. This became less as it approached the nape, where it was reduced to one-fifteenth of an inch. On examining the remains of the burnt head and face, it was found that the skull was fractured and that the tongue protruded remarkably from the mouth. Between the larynx and lower jaw, there was a depression such as might have been caused by a cord or ligature—but the mark was not so clear or distinct as that at the back of the neck.

From this condition of the neck and tongue, Schuppel drew the conclusion that the boy had died from strangulation, and that the ligature had been applied to the neck while he was living, and had been burnt with the body[1] Schuppel found by experiment that when a ligature was drawn tightly and left on a *dead* body submitted to fire, it for a time protected the depressed portion of skin, and although ultimately consumed, it allowed the part compressed to retain the smoothness observed in this case. When the ligature was applied with all the force required to produce strangulation, but removed before the application of fire, the appearances of the depression or mark were lost when fire was applied, owing to the swelling and blistering of the skin. The man accused of this double crime alleged in defence that a beam might have fallen and produced the mark observed on the neck; but this would not explain the facts. The protrusion of the tongue was a strong proof of the strangulation of a living person. The man was found guilty of the murder of his wife and stepson.

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[1] Horn's *Vierteljahrsschr.*, 1870, 2, 140.

Garrotting or Garrotte robberies. The nature of the proof required of facts, which under these assaults can rarely admit of direct proof, greatly favours the assailants. The attack is made during darkness; the victim is seized by the windpipe from behind, or a bandage is thrown around his neck; and this is suddenly tightened, while accomplices are engaged in perpetrating robbery. The nature of the assault, by pressure on the windpipe, renders it impossible for the victim to give an alarm or to call for assistance If the victim recovers, he is seldom able to identify an assailant. He is attacked from behind, is rendered immediately senseless and powerless, and can rarely offer any resistance. Recovery or death in such cases depends on the lapse of a few seconds, more or less, during which the constriction of the neck is continued—on the degree of constriction, and the age, sex, and strength of constitution of the person assaulted. An attempt at strangulation, as in garrotting, besides inflicting serious local injury to the windpipe and other parts near to it, may cause a state of insensibility which may continue for some hours. There is severe pain in the throat, with difficulty in speaking and swallowing, and if the larynx is seriously injured, there may be loss of voice. Loss of speech, however, is not one of the secondary symptoms; and loss of voice is usually only temporary during the pressure.

By the Offences against the Person Act, 1861, s. 14, it is enacted that "*whosoever shall attempt . . . to drown, suffocate, or strangle any person, with intent . . . to commit murder, shall, whether any bodily injury be effected or not, be guilty of felony.*"

Section 21 of the same Act is intended to prevent the crime of *garrotting*:—

"*Whosoever shall, by any means whatsoever, attempt to choke, suffocate, or strangle any other person, or shall, by any means calculated to choke, suffocate, or strangle, attempt to render any other person insensible, unconscious, or incapable of resistance, with intent, in any of such cases, to enable himself, or any other person, to commit, or with intent in any of such cases thereby to assist any other person in committing, any indictable offence, shall be guilty of felony.*"

Nature of the Ligature and its Method of Application. In all cases of fatal strangulation resulting from an act of suicide, the means by which strangulation was produced must be found upon the neck. The condition of the mark on the neck, the course and direction of the cord, the way in which it was secured or fixed in order to produce effective pressure on the windpipe, the amount of injury to the muscles and parts beneath, are circumstances from which, if observed at the time, a correct medical opinion may generally be formed. If the means of constriction are removed, or the cord or ligature is loosely applied, these facts, unless explained, are presumptive of homicide.

Thus, if the cord or ligature should be found loose or detached—if the ecchymosis or mark in the neck should not accurately correspond to the points of greatest pressure—if, moreover, the means of constriction were not evident when the body was first discovered and before it had been removed from its situation, there would be fair grounds for presuming that the act was homicidal.

If the ligature be still around the neck, the position of the knot may throw some light upon the case; if tied in two or three knots at the back of the neck, the presumption is in favour of homicide. The nature of the ligature may be of importance. Suicides generally employ for ligatures those articles of clothing which belong to them and are nearest at hand—such as handkerchiefs, stockings, or garters.

In all cases the ligature should be examined in order to determine whether it bears upon it marks of blood, or whether hair or other substances are adhering to it. It should be reserved for purposes of identification. In many cases of homicidal strangulation, the ligature found around the dead body was proved to correspond with portions of the same material found in the possession of the person who was charged with the murder. In removing the ligature from the neck, the way in which it is secured should be noticed, as this may be a fact of importance in reference to the allegation of suicide.

On other occasions, the disposition or nature of the ligature has enabled a person bent on suicide to strangle himself without much difficulty. An instance is related by Orfila in which two cravats, that were twisted several times around the neck of the deceased, who was discovered lying on his bed, had effectually served the purpose of suicide. Sometimes strangulation had been suicidally effected by a rough cord passed several times around the neck, and tightened by being pulled with each hand. The number of coils causes some pressure to be exerted, even when the grasp relaxed in death. Other cases are reported, in which suicides have succeeded in strangling themselves by tightening the ligature with a stick; or when the ligature was formed of thick and rough material, by simply tying it in a knot.

A young woman was found dead in bed, lying on her face, with a woollen garter passed twice round her neck, and secured in front by two simple knots, strongly tied one on the other. The body was in an incipient state of putrefaction but still there was a mark corresponding to the ligature. This was shallow, of a slight greenish colour, especially in front, and presented here and there ecchymosed spots; the mark was scarcely visible behind. The face was livid and swollen: a quantity of bloody mucus escaped from the mouth and nostrils. The lips were livid: the tongue was protruded and firmly compressed between the teeth: the body presented over the trunk and limbs patches of ecchymosis. On cutting into the mark on the neck there was no extravasation, neither was there any apparent injury to the deep-seated muscles or adjacent parts; the lungs were gorged with blood, but the other viscera presented no particular appearance.

The medical examiners gave it as their opinion that the deceased had died from apoplexy resulting from strangulation. They stated that the head had not been examined, and they judged from the condition of the face that apoplexy was the cause of death. A more important question was whether the strangulation was suicidal or homicidal. There was some reason to suspect the latter, and a person was mentioned as the probable murderer; but a rigorous medical investigation, relative to the state of the body and clothing, as well as numerous collateral circumstances, satisfactorily established that this was a case of suicide.

The dead body of a woman, *æt.* 40, was found strangled. Her husband had left her, at 8 a.m., in a nervous, depressed condition. On his return to dinner at midday, he discovered her stretched at full length upon the bed with some thin twine twisted around her neck, and fastened to the iron rails at the head of the bedstead. She was black in the face, and lying about two feet down the bed. He at once cut the string from her throat, and ran for a medical man, who, on his arrival, found that the woman had not been long dead. The body was straight. The features were very much distorted. She appeared to have struggled, but the bed-clothes were smooth, and so were her own clothes. The case was clearly one of suicidal strangulation. The woman had previously been confined in a mental hospital.

In *R.* v. *Cooper*,[1] the prisoner was convicted of the murder of his son by strangulation. In this case a twisted cotton handkerchief was found round the neck of the deceased, a boy only eight years old. It was tied tightly, and with a double knot; a finger could not be introduced between it and the neck. The face had a bloated appearance; the tongue protruded, and the teeth were deeply indented into it. The surgeon rightly concluded that this was a case of homicidal strangulation.

The carelessness with which inquiries are sometimes conducted is illustrated by the fact that in *R.* v. *Browning*,[2] in which the prisoner was convicted of murder by strangulation, the verdict of the coroner's jury was to the effect that the deceased had strangled herself in a fit of temporary insanity. In this case the cord had been twisted tightly twice around the neck and then tied in a knot.

The way in which the notorious criminal Greenacre attempted to kill himself by suicidal strangulation presented some novelty. While he was in custody at a police station, he was found by an inspector, lying on the floor with a handkerchief drawn tightly around his neck by means of a loop, into which he had inserted his foot. When first seen his face was livid and he was apparently dead; the handkerchief was cut, he was bled, and other means of resuscitation were employed with success.

The manner in which General Pichegru was found strangled in prison gave rise to a strong suspicion of murder, merely from the singularity of the method adopted. The ligature which he used was found tightened around his neck by means of a stick, which had been twisted and then fixed behind one ear; there was no lividity of the face. It was alleged that Napoleon I. had caused the General to be strangled or suffocated, and that the ligature had been applied afterwards. The evidence that this was an act of homicide was very weak; and, having regard to the medical evidence, there is no reason to doubt that it was an act of suicide. The only obstacle to the admission of this, in the opinion of some jurists, was the use of a stick for the purpose of tightening the ligature. There are, however, at least two similar cases on record, in which a suspicion of suicide could not be entertained. One of these is as follows:—

In *R.* v. *Drory* the body of a young woman was found lying upon the face, strangled, with a rope coiled three times around the lower part of her neck; the two inner coils (involving the windpipe) were tight, the outer coil loose, the end of the cord being placed loosely near the left hand of the deceased, which was raised towards it. The length of the free portion of cord was not sufficient to allow of the deceased grasping and tightening it to such a degree as to produce the great amount of violence found on the neck. The windpipe was flattened and its canal completely obstructed by the pressure of the two inner coils of rope.

Assuming that a person could draw one coil so tightly, the deceased could not have retained the power of drawing a second coil with equal force, and subsequently a third coil. Fleischmann's experiments prove that pressure on the windpipe, *sufficient to flatten it*, frequently produces instantaneous insensibility and loss of power. The evidence, medical and circumstantial, clearly traced the crime to the prisoner, and he was convicted.

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[1] Shrewsbury Lent Ass., 1863.

[2] C.C.C., Dec. 1845.

No hard and fast rule can be laid down on the subject ; it is necessary to judge each case on its own merits.

In the following case there was evidence of design, and also evidence that no other person could have been near at the time, so that suicide was certain.

An inquest was held on the body of a man, aged 40, who was found lying dead on the floor of his room dressed only in his undervest. Around his neck was an ordinary piece of string, which he had tightened by passing the handle of an umbrella through the loop and twisting it around at the back of his head. A verdict of suicide during temporary insanity was recorded.

Position of the Body. In the sub-section on " Hanging," it is stated that in many cases the body of the suicide is found in contact with the ground ; and cases are described in which hanging took place in this manner, while the suicide was in a sitting or kneeling posture.

It is obvious that precisely the same reasoning, although with greater force, applies to the position of the body in strangulation, although at the same time the other points, such as the marks on the neck, etc., are to be here considered as more pertinent than the mere position of the body.

Circumstantial Evidence. In contested questions of suicidal or homicidal strangulation, the court must be greatly influenced by evidence as to the circumstances as well as by moral presumptions. How far a medical witness is allowed to make use of these factors in the formation of an opinion it will be for the court to determine. Generally speaking, his duty is strictly confined to the furnishing of evidence of medical facts alone. But there are numerous circumstances of a collateral nature which may materially modify an opinion. Thus the nature of a ligature, the state of the clothes, and the posture of the deceased when found, although not strictly medical circumstances, bear directly upon medical opinions. Without circumstantial evidence, the best medical opinion in these cases will often amount to nothing. It is a mistake to suppose that in all cases the court must have regard to medical circumstances *alone* for clearing up intricate questions. On some occasions the conflicting theories of homicide or of suicide will be equally consistent with the facts.

The following case was pronounced to be a case of *suicidal* strangulation by some, and of *homicidal* by others. A servant girl was found dead in her bed. The body was rigid and lying in a constrained position, with the face turned to the right, and there was a handkerchief so firmly tied around the neck that it was with some difficulty removed. A quantity of froth and bloody mucus escaped from the mouth and nostrils. The knot in the handkerchief which was tied around the neck was on the *left side*, as it is customary to find it in left-handed people. The deceased was not left-handed, and there was no reason to suspect that she had intended to commit suicide ; she went to bed the night before in her usual health and spirits. There was no mark of violence externally, but there were large patches of cadaveric lividity scattered over the skin. There was a deep impression of a necklace on the skin of the neck, which had resulted, it was supposed, from the force with which the handkerchief had been tied. The neck appeared swollen, especially on the right side. On opening the head, the vessels of the brain were found distended, especially on the right side; and on this side about half an ounce of blood was found extravasated. In the mouth the tongue projected forwards between the teeth, but was uninjured by them. The contents of the chest and abdomen presented nothing unusual; the lungs were gorged with blood. The medical examiners attributed death to strangulation, and in their judgment the act was not suicidal.

Among the reasons assigned for this opinion were the facts that the handkerchief was tied on the neck in *two knots*, and that the deceased could not have tied more than one; her senses would have failed her before she could have made a second, or at least before she could have made it so securely as the first. The position in which the body was found, the conduct of the deceased before her death, and the absence of all motive, were facts also adverse to suicide; but as no criminal could be pointed out, it was suggested that the act was suicidal. It is difficult to believe that any person who did not contemplate suicide would retire to rest with a handkerchief tied in a double knot *so tightly* around the neck as to render it very difficult to remove: it was evidently so tight that strangulation might easily have resulted from the constriction. The apoplectic appearances in the head may have been due to the impeded circulation of the blood, in consequence of the ligature. There was, therefore, nothing to contradict the opinion of death from strangulation: no morbid cause capable of giving rise to sudden death (except effusion of blood on the brain, which has already been accounted for), was discovered in the body. Whether the ligature was placed around the neck by the girl herself, or by another, may be a matter of doubt: yet when we consider that there was nothing absolutely impossible in the act on her part, that there were no appearances of violence about her person or clothing, and no evidence that any person had access to the room, it appears most probable that the strangulation was *suicidal*.

Sometimes circumstantial evidence is almost the only ground for a suggestion either of suicide or of homicide: time, place, locked doors, fastened windows, motives, etc., etc., are all important factors.

Cases. *Homicidal Strangulation. Evidence largely Circumstantial.* Arthur Shaw was tried for the wilful murder of his wife. On the evening of November 3rd, he came home at about 8.30, and finding that his wife had gone into a neighbouring house, called there for her. They returned home together. They were both sober, though Shaw was wearing his hat on the back of his head, and looked excited and surly. A few minutes later the neighbour's wife took Shaw's little girl home, handing her to her mother. Soon afterwards she went out on an errand, and as she passed Shaw's door, she heard moans, whereupon she knocked at the door, shook it, and tried to open it; but as no one answered, she went on about her business, and returned in five or ten minutes. In the meantime Shaw had been to ask for assistance, saying that he and his wife had had a little bother, that his wife had fallen into the fireplace, and that he feared she was dead. Two men had gone back with him into the house, and had there found in the room on the ground floor the prisoner's wife sitting on a chair, with her head leaning back against the wall, apparently dead. The ashpan was in its proper place, and the fender and fire-irons did not appear to have been disturbed. There were marks of blood on the table and wall, and also on the floor of the room, which was a very small one, being only about three and a half yards square. On being charged with the murder of his wife, Shaw protested his innocence. He afterwards stated that his wife refused to go to bed when he wished her, and that on her attempting to leave the house he interfered to prevent her, and that she then fell into the fireplace, owing to her foot having caught in some old sacking which served as a hearthrug. At the *post-mortem* examination there was found a bruise, with extravasation, immediately beneath the lobule of the left ear; and another, also accompanied with extravasation, three-quarters of an inch below the lobule of the right ear. Corresponding to this latter bruise, a second effusion of blood had taken place into the deeper tissues, half an inch beneath the surface. Other bruises were found over each eyebrow, at the back of the right wrist, over the knuckle of the left little finger, at the inner side of the left elbow, and at each angle of the mouth. Within the mouth at the line of reflection of the lower lip, on the left side, was a contused and lacerated wound opposite the jagged stump of the canine tooth, and exactly opposite to this at the line of reflection of the upper lip on the same side, there was another small bruise, accompanied with extravasation. The tongue was bruised on the right side, as though it had been caught between the teeth. The left lateral incisor tooth in the upper jaw was partially loosened, the torn gum and effused blood showing that the injury was recent. The blood in the body was dark and fluid. The brain and membranes were intensely congested, the blood pouring out in considerable quantities on removing the calvarium. There were no marks of injury to the throat, either externally or internally. The lungs were congested, and exhibited patches of emphysema on their surface. The heart contained a quantity of dark fluid blood. The abdominal viscera were healthy, and not noticeably congested. There had been an escape of urine and fæces. In the opinion of the medical witnesses, death was caused by strangulation, the neck having been grasped between the fingers and thumb while the chin was raised. The marks indicated that the pressure had been applied behind the angles of the jaw over the internal jugular veins, which would account for the intensity of the intracranial congestion. The defence was that death was caused by apoplexy. The jury ultimately returned a verdict of guilty of wilful murder, at the same time recommending the prisoner to mercy. The prisoner was sentenced to death and executed, in spite of efforts to obtain a reprieve. What weighed strongly with the judge was his refusal to open the door when the neighbour knocked at it, shook it, and tried to open it. The evidence of the police and other witnesses also flatly contradicted his story of his wife having fallen into the fender, in addition to which such fall would not have caused the injuries found.

Homicidal Strangulation. Evidence Circumstantial. Signs of a Struggle. Marks on Neck. A man was tried for the murder of a woman with whom he cohabited. Her death had been caused by that form of strangulation known as throttling, and the interest attaching to some of the internal *post-mortem* appearances induced Cullingworth to put the case on record. The accused man and his companion occupied a room on the ground floor of a house. Access to the rooms was by a common outer door opening into a small lobby or entrance from three to four feet square, of which the left side formed the door of the room where the catastrophe occurred; and at right angles to this, facing the entrance, was the door of another room inhabited by an old man and his wife, who were the principal witnesses, and who must have seen any person enter the adjoining apartment, after the closing of the outer door for the night. Late in the evening of Saturday, December 26th, the accused and the deceased woman were seen in their own room sitting alone. Both of them were drunk. They then appeared to be on good terms and were drinking beer together. About one o'clock in the morning the old people on the same floor were startled by a noise as of a table being capsized, followed by a loud crash of breaking pots; some moaning was heard shortly afterwards, and then all was still. At half-past five the accused man tapped at his neighbour's door and asked for a light. A candle was lent to him, with which he went back to his room, and presently returned, having found the woman, by whose side he had been lying asleep, dead and cold.

At nine o'clock on the morning of the 27th the room presented the following appearances. A large round table was lying on its side, an arm-chair in one corner was also thrown over and three of its legs were broken, the floor was strewn with broken pots of all sorts and sizes, and in the middle of the room lay a mass of solid human excrement. In a washing-bowl on a side table, composed of an old box, was a quantity of dirty water, on the surface of which solid excrement was floating. On a low bedstead in one corner the body of a woman lay on her right side, dressed in everyday clothing, and in a condition of *rigor mortis*. The face, more particularly on the right side, was swollen and livid, and a little blood had oozed from the mouth, nose, and inner angle of the eyes. Immediately over the larynx, and on each side of the middle line, there were livid marks of irregular outline, such as might be caused by the pressure of thumb and fingers. There were also several dark bruise-like discolorations on the flexor surface of both forearms; the hands were clenched and the elbows flexed. There had been a discharge of fæces from the rectum.

The *post-mortem* examination was made on the evening of the same day (Sunday, the 27th) by Cullingworth and Dreschfeld. The valves of the heart were free from disease, and *all the cavities of the heart were empty.* There were no signs of injury to the hyoid bone or cartilages of the larynx, the mucous membrane lining the larynx and trachea was congested and covered with frothy mucus. The lungs were intensely congested, in several places hæmorrhage had taken place, and masses of lung tissue, some of them of considerable size, were found on both sides, chiefly towards the bases solidified from the presence of the effused blood. The stomach was empty and normal, and no congestion was met with in any of the abdominal viscera. The head revealed a perfectly natural condition of the brain and its membranes. Cullingworth gave it as his opinion that death resulted immediately from congestion of the lungs, caused by a forcible and recent stoppage of the respiration. He considered that the marks on the front of the neck were most probably marks of the thumb and fingers, and maintained that pressure continuously exerted at that spot for a period of three to five minutes would cause death and account for the internal appearances. In answer to a question put to him by the judge as to the possibility of a person moaning after fatal pressure of this kind, Cullingworth denied the possibility, and he suggested that the moaning probably occurred previously when the bruises were received on the arms. On the whole, it seemed likely that the accused, desiring the woman to retire to bed, became irritated at her obstinate refusal, and proceeded to hold her down by the throat, his condition of drunkenness obscuring his estimate of the consequences. The man was found guilty of manslaughter. The points of interest were: (1) Absence of signs of cerebral congestion; (2) the number and extent of the hæmorrhages into the lungs; and (3) the emptiness of the heart's cavities on the right side.[1]

Homicidal Strangulation. Evidence of Wounds. Marks on Neck, but Ligature the Doubtful Point leading to Acquittal. An inquest was held on the body of a woman who lived in a small street near a leading thoroughfare. The deceased and a man named Fowler were heard quarrelling one evening, and the woman was heard by the neighbours to say, "You dare not do it," presumably "You dare not kill me." A scuffle ensued, she screamed, and all was quiet. Some time after, when persons went to the room, Fowler had to remove a table which was against the door to let them in. She was then found to be dead, lying on the sofa in a straight position. A police inspector removed a handkerchief which was found around the throat. The following are the external appearances found at the *post mortem* examination. The face was congested, the pupils semi-dilated, the right eyelid ecchymosed, conjunctiva ecchymosed and injected; left eyelid ecchymosed, result of violence many days before. Inner surface of upper lip cut just to right of centre about ½ inch long, ⅛ inch deep. Lower lip had internal bruise, and both marks apparently due to same violence; slight swelling of integuments of chin. On the neck there was a mark of circular constriction extending all round but more plainly visible at back and sides, not much in front (only on careful inspection); the breadth of this mark was from 1 inch to 1⅛ inch, no excoriation. No other external marks of violence. Internally the lungs were congested generally, including the apices and superior surfaces; the right one was healthy, the left showed signs of old pleurisy. In the heart the right side was distended with dark semi-fluid blood, the left side empty, it appeared healthy; the valves were all healthy. The tongue was ecchymosed at base with effusion corresponding to other marks of violence; mucous membrane congested at the back of the tongue; the tonsils were enlarged and congested. The larynx was normal except for the epiglottis, which was congested (dotted ecchymoses), the trachea was congested and empty, the bronchial tubes were congested; lower tubes contained some bloody mucus mixed with air. The pharynx was slightly ecchymosed at the part corresponding to the constriction, especially behind the cricoid cartilage. The brain was somewhat congested but healthy; the stomach was nearly empty, some small quantity of contents escaping when removed, it was ecchymosed at the cardiac end. The blood was fluid throughout the veins. The liver and kidneys were congested; all the other organs were normal. The deceased was menstruating at the time of death. The coroner's jury returned a verdict of wilful murder against Fowler, who was duly committed for trial. At this the medical witnesses expressed a very strong opinion that the strangulation could not have been self-inflicted, but each declined to swear that it was impossible for her to have done it. The handkerchief was an ordinary woman's black silk tie. The jury acquitted the prisoner.

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[1] *Lancet*, May 1st and 29th (vol. 1, 1875, pp. 608 and 776).

Homicidal Strangulation. Evidence from Marks on Neck and Injury to Trachea. A Liverpool sailor took a woman to chapel for the purpose of marrying her, but being too late the ceremony was not performed; he then took her to his lodgings. At night he went to bed with the woman; a friend sat or lay all night at the foot of the bed. About four o'clock on the morning of the 9th they both came downstairs. One went to the privy, the other to purchase some rum, saying to the mistress of the house that the woman upstairs was ill. They both shortly went again upstairs, and some little time afterwards summoned the mistress. She went upstairs, but did not see the woman as her face was covered up. She went immediately for Mr. Stewart, surgeon. He arrived at 8.30 a.m. and found the woman dead. He was told that she had been seized with vomiting and purging, but he saw nothing to indicate one or the other. Mr. Stewart knew nothing of the previous history of the case, and had no suspicion that there had been foul play. He found her lying upon her back, extremities cold, and body getting cold, rigidity commencing, the arms extended at her sides, face natural, no protrusion of the tongue, in fact, nothing to attract particular notice. He concluded that she had been dead about two hours. Some rumours having got abroad, he and his partner Hill, were requested by the coroner to make a *post-mortem* examination; this was done on the 11th, about fifty-eight hours after death. There was no discoloration of the neck, but it was swollen particularly on the right side, and when pressed upon, produced the crepitating feel of emphysema; this extended down to the back, shoulders, and chest of the same side. On making an incision in the mesial line, no extravasation of blood was found amongst the soft parts; on pushing the muscles aside with the handle of the scalpel, a small clot of blood the size of a four-penny bit was seen on the right side of the trachea; around this clot was a slight effusion of fluid blood, and the cellular tissue was softer and more easily broken up than elsewhere. On removing the clot, an opening into the trachea was found directly under it, and on further examination another opening into the trachea was found, rather more in front. The larynx and trachea were then removed; a considerable amount of frothy fluid was found in the trachea, the lungs were distended with air; they were much congested posteriorly, the right side of the heart was distended with blood, partly fluid, partly coagulated; the left side was also filled with blood, but not distended. On the afternoon of the same day (11th July) the trachea was taken to Long, a Liverpool surgeon of great experience, for many years lecturer on anatomy at the Liverpool Medical School. He examined the body, which had been opened in the morning; the weather was excessively hot, decomposition rapidly advancing. There was nothing to be noticed except the trachea, which was examined the next day (12th); after being all night in spirit and water, Long found the second ring on the right side broken with absence of a small portion of the ring, thus leaving a small opening. The third and fourth rings were broken through perpendicularly near their centres; three or four rings below these were cracked, but not broken through; the fractured ends presented a clean, not a jagged, surface, the mucous membrane had, however, a jagged appearance, as if torn; it was of a dark port-wine colour, being deepest at the injured parts, and fading gradually in colour as it was more distant from them. The trachea at the injured parts resisted pressure when made directly in front, but when the pressure was made obliquely at both sides at once by the finger and thumb, it gave way, and the parts overlapped each other, producing the impression that the injury had been inflicted by pressure in the direction above indicated.

Long, who was a strong, powerfully-built man, tried on the body of a woman of about the same age (twenty-six), recently dead, to break the trachea by making pressure with his thumbs obliquely at the sides of the neck and on the trachea, having the fingers behind the neck. He used all the force he could exert, getting an assistant in addition to place his thumbs on his to increase the pressure. On dissection, the trachea was found uninjured. He also tried to fracture the tracheal rings of a lamb (just removed from the body), by forcible compression between the thumbs, but did not succeed. He easily fractured those of a sheep by the same proceeding. The rings did not all break at the same line, but irregularly; the fractured ends, however, were quite smooth as if cut. Long, Stewart, and Hill, were of opinion that the woman had been strangled, most probably by the hands being placed behind the neck, and applied at the sides of the trachea, and that to produce the appearances found in the *post-mortem* examination, the cause could not have occurred after death, the antagonistic action of the air suddenly confined in the trachea being necessary for this purpose, that the appearances could not well be produced by the surgeon in removing the trachea. Long directed attention to the lacerated mucous membrane presenting the appearance of being torn by a force operating from within, *viz.*, by the expulsive efforts of expiration. He also pointed to the blood staining at the injured parts. The sailor was committed for trial; but the case did not proceed to trial.

The mixture of cunning and stupidity which characterises some criminal acts was well exemplified in the case of a Dundee murder, in which the prisoner went to the police station and informed the officer on duty that his wife had hanged herself some days ago, but on the officer returning with him to the house, there was no nail on the wall or any mark to show that one had been there to which the deceased could have fixed the cord. The case was clearly one of homicidal strangulation.

Alleged Strangulation. Hitherto the subject of strangulation has been considered in reference to the dead. But a living person may charge another with attempted murder by strangulation in which case a medical witness may be called to give evidence. An impostor rarely causes such injury to himself as to place his life in jeopardy. The cord is loose around the neck; it is not secured so as to press with great force on the air-passages, or to cause the tongue to protrude, or to produce lividity of the face or neck, or ecchymoses in the conjunctivæ and the skin. An imposter uses either a ligature or a rope; he does not usually resort to manual violence to his throat. The marked feature of a truly homicidal attempt is the great amount of violence applied to the neck; and the account given by the imposter will be inconsistent in its details, and not reconcilable with the ordinary effects of homicidal strangulation.

A French merchant was charged by his servant, Roux, with having attempted to murder him by strangulation. The case ended in a complete acquittal of the accused. At eight o'clock in the evening, Roux, a man in the prime of life, and the servant of the accused, was found in a cellar of his master's house, stretched on the floor, his feet and hands tied; he was apparently strangled, and, it was said, almost lifeless. Under medical care, in less than three hours, however, he completely recovered. On the next morning (as he professed to be unable to speak) he informed those about him, by signs, that his master came upon him unexpectedly while he was in the cellar, scolded him, struck him a severe blow on the nape of the neck (which knocked him down), attempted to strangle him, and then bound him with cords, and left him on the floor as he was found. The injuries, according to him, were inflicted at half-past eight in the morning, so that on his own statement he had been lying on the cellar floor, in a helpless state and unable to give an alarm for more than eleven hours.

The merchant denied the charge, and alleged that the whole statement was a falsehood. No motive could be suggested for such conduct. No corroborative evidence could be adduced in support of the charge, and it rested simply on the word of one man against the word of another. Roux was found lying on his left side with his face towards the floor, and his legs were tied with a handkerchief which belonged to the merchant. From Roux's position in the household, it was very easy for him to procure the handkerchief from his master's wardrobe. His arms were cold, his head and face of a natural warmth, the breathing stertorous or loud, the pulse scarcely perceptible, and the eyelid and eye almost insensible. There was around the neck a cord about one quarter of an inch in diameter: it was coiled three or four times round, and was not secured by a knot. There were some marks about the neck, not ecchymosed, and widely separated from each other. There was no injury to the skin, and there were no marks on the neck such as the coils of this cord would have produced if it had been applied with any force by an assailant. The cords bound around the legs and wrists could have been applied by Roux himself. As there was no swelling around them, it was obvious that they could not have been applied for upwards of eleven hours, as stated by the accuser, but only within a short time of his being discovered in the cellar.

The time assigned by this man for the malicious assault was fatal to his story. The cord around the neck had not been applied with sufficient force to interrupt respiration in any degree. This was not only proved by the absence of any marks on the neck corresponding to it, but by the circumstance, according to his statement, that he had been in the same position eleven hours. If this had been true, and the cord applied so as to produce the imminent symptoms of strangulation he described, he would have died from the effects within an hour after he had been so maltreated. Men who strangle others either draw a cord tightly or secure it by a knot. The pressure to the neck is not so gentle as to leave no mark whatever, or to allow the strangled person to breathe and watch all that goes on around him for a period of eleven hours. There was therefore nothing in this man's state which might not have been self-produced; whereas, on the other hand, all the facts were inconsistent with the allegation that a homicidal attack had been made upon him by another. There was no trace of any blow on the nape of the neck, and the violence described, if it had been inflicted, would have left some strong evidence thereof. In the absence of this there was total lack of corroboration of Roux's story. Although he stated that he was rendered insensible by the blow, yet he was able to observe and to describe minutely the proceedings of the merchant as to the subsequent strangling, and the binding of his legs and arms. No injury was done to the larnyx in any way; yet he professed to be dumb, and unable to speak. It is highly probable that a short time before he was discovered he himself had arranged the ligatures about his body.

It is obvious that circumstantial evidence must play a great part in establishing or rebutting a charge of this kind.

HANGING

Definition of Hanging

By hanging we understand that form of death in which the body is wholly or partially suspended by the neck so that the constricting force applied to the neck is the weight of the body acting upon the ligature used as its point of support. It differs from strangulation in that in the latter the neck is constricted by some external force other than the weight of the body.

Symptoms of Hanging

These are of little medico-legal interest, but they are mentioned because they throw light on the cause of death in this form of violence, and also explain how easy it is for accidental and suicidal hanging to occur.

We learn from those who have been resuscitated, as well as from experiments performed by persons upon themselves, that in death from hanging, insensibility takes place in the most insidious manner, and that a slight constriction of the windpipe can speedily produce loss of consciousness and muscular power. The only symptoms of which hanged persons have been conscious were a ringing in the ears, a flash of light before the eyes, then darkness and oblivion. The only useful inference which can be drawn from observations of this kind is, that insensibility is not only rapidly induced, but also that it supervenes in circumstances where it would not be generally expected to occur—*i.e.*, when the body is in great part supported. Fleischmann found that a cord might be placed round his neck between the chin and hyoid bone, and tightened either laterally or posteriorly, without perceptibly interrupting respiration; but while the respiratory process was thus carried on, his face became red, his eyes prominent, and his head felt hot. These symptoms were followed by a sense of weight, a feeling of incipient stupefaction, and a hissing noise in the ears. On the occurrence of this last symptom, the experiment, he says, should be discontinued, or the consequences may be serious. His first experiment on himself lasted two minutes; but, in the second, owing to the cord more completely interrupting respiration, the noise in the ears appeared in *half a minute*. When the pressure was applied on the windpipe the effect was *instantaneous*, but when on the cricoid cartilage it was not immediate. If it were applied between the hyoid bone and the thyroid cartilage, or on the hyoid bone itself, the period during which a person could breathe was extremely short; and this result was more striking when the act of expiration was performed at the moment of applying the pressure. Hammond had himself partly strangled in a chair. A towel was passed round his neck and the ends twisted together by a medical friend, while another friend stood in front to watch the face and make necessary tests. As the twisting proceeded, Hammond first noticed a sensation of warmth and tingling, which began with the feet and spread over the body; vision partly disappeared, but there was no appearance of coloured lights. The head felt likely to burst, and there was a roaring in the ears; consciousness continued, and he could tell his friend whether he suffered pain from the knife-thrusts being made into his hand. In one minute and twenty seconds from the commencement, all sensibility ceased. In another experiment sensibility ceased in fifty-five seconds. A knife-thrust, sufficient to draw blood, caused no sensation whatever.

It is not improbable that persons have lost their lives by privately attempting these experiments, and their cases have been set down to acts of suicide. There is reason to believe that boys have thus unintentionally killed themselves, from a strange desire to imitate or from curiosity. The following is one among many instances of this kind:—

A boy, aged fourteen, witnessed an execution at Nottingham, and he was afterwards heard to say that he would like to know how hanging felt. On the same afternoon he was found suspended by a cord from a tree, dead; and from the circumstances there could be no doubt that he had been experimenting on the theory and practice of hanging, and that he did not intend to kill himself. The jury returned a verdict of "Accidental hanging."

It is seen from the above facts that a person who is in danger of death from hanging has very little time to extricate himself from the noose, even if he should wish to do so. The rapid loss of consciousness in these cases is remarkable, and is due to a combination of effects from pressure on the carotid sinus, the nerves, the great vessels and the air passages.

Causes of Death in Hanging

From the great differences with regard to the distribution of the blood in the internal organs of those who have died from hanging, it has been concluded that the actual cause of death is not always the same. There are undoubtedly at least four or five ways in which death might take place, but experience has to some extent reconciled the various *post-mortem* appearances with a common cause of death, *viz.*, asphyxia, which may be associated with varying instead of uniform results. We must, however, consider the various possible views. Death may take place from—

Simple blocking of the air-passages (asphyxia pure and simple).
Congestion of venous blood in the brain (pressure on jugular veins).
Lack of arterial blood to the brain (pressure on carotids).
Syncope from the pressure on the vagus nerves, or carotid sinus.
Injury to the spinal column and the cord.
Combinations of any of the above.

Simple Blocking of the Air-passages. Both experiments and observation on persons hanged have shown that this is very easily brought about, its occurrence depending on the position of the ligature above or below the larynx and upon the degree of force used. Maschka found the ligature above the larynx in no less than 149 cases out of 153, and this is to be expected when it is considered how easily a rope slips up to the highest part of the neck. The pressure of the ligature compresses the tissues of the neck and forces the base of the tongue against the posterior wall of the pharynx. When the air-passages are thus blocked, asphyxia must naturally be the prominent cause of death with corresponding *post-mortem* appearances.

Venous Congestion of Brain. When a ligature is applied round the neck the principal venous trunks undoubtedly become somewhat compressed, and as they form the main channels for the return of blood from the brain, stasis in the venous circulation in the brain is likely to be produced. From clinical experience we know that such a condition may cause unconsciousness, and it may take a share in the production of death in hanging. Actual extravasation of blood from the intracranial vessels from this cause is very rare; the result (unconsciousness) seems to be produced by the mere interruption to the removal of venous blood.

It has been shown that the precise point in a respiratory cycle at which hanging takes place affects the results as follows: if an animal is hung at the end of full inspiration, the lungs contain little blood and the brain sinuses are congested. The opposite condition prevails if an animal is hung at the end of expiration. This explanation may be very satisfactory from an academic point of view in reconciling the various *post-mortem* appearances, but is of slight medico-legal importance when applied to human beings.

Anaemia of the Brain. The general constriction of the tissues of the neck by the ligature tends to compress the carotid arteries, and this factor no doubt contributes to the rapid loss of consciousness observed in hanging. In violent hanging (judicial or homicidal) there are observations showing that the carotids occasionally get blocked by actual rupture of their inner coats.

Physiologists are now quite agreed that the brain cannot stand interference with its blood renewal (arterial supply and venous removal) for more than four or five seconds without serious derangement and loss of function (Mott).

Syncope from Pressure on the Vagus Nerves and Carotid Sinus. Hoffman first suggested that pressure on the vagi might be a cause of death in hanging; but considering their position behind and between the carotid artery and jugular vein, it is unlikely that the nerves could be affected by pressure without the artery and vein being also affected. If they were factors they would cause rapid stoppage of the heart, but we have seen (" Asphyxia," p. 519), that in death by hanging, the heart frequently continues to beat several minutes after all other signs of life have ceased. Pressure upon or traction of the carotid sinus may lead to inhibition of the cardiac function.[1]

Injury to the Spinal Column and Cord. This can only take place when the hanging may be described as violent. Suicides occasionally give themselves a drop, but it may be said generally to occur only in judicial hanging. Devergie found the ligaments between the first and second vertebræ of the neck ruptured only once in fifty-two suicidal cases.

Judicial Hanging. In executions instantaneous death is certainly desirable, and it seems probable that such is now always attained by means of a drop graduated in length inversely to the weight of the criminal. The same result was attained in former days by giving a rotatory movement to the body at the moment the bolt was drawn, whereby the odontoid process of the axis was displaced and caused instantaneous death by pressure upon or laceration of the spinal cord.

It is often reported that after judicial hanging the body gives violent convulsive movements. These movements can by no stretch of the imagination be taken as indicating consciousness or knowledge on the part of the person hanged; they are merely the movements which might be expected to take place by reflex action. It is true that clinically we meet with cases of persons who have broken their necks not only remaining conscious but even recovering; but the circumstances are there very different from hanging, in which, by the drop, such extension is applied to the cord as to cause rupture of the cervical cord and instant unconsciousness and death. The reports of *post-mortem* examinations on hanged criminals usually include a statement to the effect that the neck was broken and death instantaneous; the injury to the spine does not always take place at the same point; fractures and dislocations about the third and fourth vertebræ (not far from the origin of the phrenic nerves) are as common as fractures of the first and second vetebræ.

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[1] Moses, H. M.. and Feinstein, S., *Annal Internal Medicine* 8: 1413, 1935. *Brit. Med. Journ* 1; 380, 1944.

Combinations of the above. The findings in autopsies on persons who have been hanged warrant the following conclusions on this matter. 1. Given pressure both on the air-tubes and blood vessels, the pressure on the air-tubes being only partial, death will probably result from a combination of asphyxia and interference with the cerebral circulation, but from asphyxia primarily. 2. Given pressure in such a position that the airway is more or less protected, death may occur from interference with the cerebral circulation, and will then be *slow.* 3. Given complete pressure, so that the entrance of air into the lungs is entirely prevented, death will result from asphyxia, and may be extremely rapid.

Death after Apparent or Temporary Recovery

It by no means follows that, because we have succeeded in restoring the respiratory process, a person is safe. Death often takes place by a relapse at various periods after the accident.

Many such cases are reported up to as long as twenty hours after being cut down. They used to be looked upon with some mystery, but a consideration of the above causes of death in the light of modern physiology and clinical experience dispels all mystery. Œdema of the lungs following on marked disturbance of the circulation through them is common. Œdema of the larynx may ensue and lead to rapid death after a certain period. Cerebral and meningeal congestion may cause a disturbance of function such as to lead to death in a longer or shorter time.

Treatment of Persons Hanged

The causes of death, as discovered by autopsy, give us some little guidance as to the best treatment to be adopted in endeavouring to restore a person who is apparently dead from hanging.

The three cardinal principles are much the same as in those which apply to the apparently drowned, *viz.* :—

1. To induce the natural act of respiration.
2. To stimulate the heart into renewed action if it has ceased to beat, or to keep it beating if it has not ceased.
3. To maintain the natural heat of the body.

To promote the first object a current of fresh air is useful, as also the vapour of ammonia. Artificial respiration (*vide supra*, p. 540), should be assiduously performed for a long time. If available, inhalations of oxygen mixed with 5 per cent of carbon dioxide should be used. Electrical stimulation of the phrenics may be of use. Obviously the ligature must be loosened, and the mouth wiped to remove all obstacles to the free entry of air ; the tongue may also be pulled forward—the position of the body is here not nearly of so much importance as in drowning (*q.v.*), so that the body may be laid on its back or chest.

The second indication may be fulfilled by applying heat to the cardiac region, and occasionally by bleeding. Hypodermic injections of coramine, strychnine or ether, and enemata of brandy are also useful for the purpose.

Friction, hot blankets, and the carrying out of the above efforts in a warm room, fulfil the third condition.

The following cases are interesting in this connection :—

A robust woman, aged thirty-three, hanged herself while slightly intoxicated. She was missed about ten minutes before she was found suspended to a bedstead, but it was impossible to determine how long she had been thus hanging. Medical assistance was rendered to her in about ten minutes after she had been cut down. She was then quite insensible—her respiration slow and laborious, and her pulse barely perceptible. The countenance was pale ; there was no lividity ; the lower jaw was depressed, the extremities moderately warm, the hands convulsively clenched, the pupils somewhat dilated and barely susceptible to light. A dusky-red mark, a quarter of an inch in breadth, was observed encircling the upper part of the neck, forming an angle over the ramus of the jaw on the right side, where the knot of the ligature (a silk handkerchief) had rested ; and in consequence of this the constriction was incomplete. The patient was twice copiously bled, mustard poultices were applied to the calves of the legs, hot water to the feet, and an ice bag to the head. After thirty-two ounces of blood had been abstracted, in half an hour the breathing became stertorous, the pupils fully dilated, the lower jaw fell rapidly, the sphincters became relaxed, and the patient appeared to be rapidly sinking. Ammoniacal liniment was rubbed on the chest, and the woman so far recovered in an hour as to be able to swallow ; but although she was conscious of pain, she remained comatose until the evening, when she became perfectly sensible of surrounding objects.

This was evidently a case of imperfect suspension, where, since respiration was continuing, there was every hope of recovery. The cerebral circulation had become disordered.

In one case *cold affusion* speedily resuscitated the person.

A man had been hanging about two or three minutes when he was cut down, and in four or five minutes afterwards he had ceased to breathe : his features were pallid, and the eyes injected with blood. The heart's action continued, although feebly ; the pulse being about 80, and very weak, Artificial respiration was tried without any benefit, when affusion of cold water was resorted to. This after a short time, led to the complete establishment of respiration : at each affusion there was a deep inspiration. The man was bled to sixteen ounces, and he soon recovered consciousness.

When great cerebral congestion is produced by a close constriction of the throat, bleeding may be found beneficial.

A man fell in with a gang of thugs, who strangled him. He became unconscious ; on recovering his senses he found that his throat had been cut, and that a fellow-traveller lay strangled to death by his side. The wound in his throat was properly treated, and the man recovered in six weeks. He was able to give a description of the gang, which subsequently led to the apprehension of four of them, who were sentenced to death.

As Chevers remarks, it can scarcely be doubted that the violent measure of cutting the man's throat effectually relieved the vessels of the brain of any undue congestion which the throttling might have produced.[1]

These cases bear out the view that in *simple* asphyxia after respiration has ceased, the heart may continue to beat for three or four minutes. It is on account of this fact that there is hope of restoring a person by artificial respiration. Convulsions, paralysis, and even severe mental aberration have been observed to follow recovery, doubtless the result of lesions induced in the brain by circulatory disturbances.

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[1] "Med. Jurisprudence for India," p. 405.

Post-mortem Appearances in the Hanged

These may be divided into three groups :—

The general external appearances.
The general internal appearances.
The special examination of the neck.

General External Appearances. These vary greatly. There may be lividity and swelling of the face, with protruding eyes and tongue, and patches of ecchymosis on the chest and upper part of body, and firmly clenched hands with purple nails. More commonly the face is pale and placid, protrusion of tongue and eyes is slight, but the lips are commonly blue or livid. Saliva may be noticed to have dribbled from the mouth, but this depends to some extent on the position of the knot in the ligature. If it is on the side, it tilts the head to one side, and allows saliva to escape ; if the knot is under the chin, it is unlikely that any saliva will dribble out. The secretion of saliva is a vital act, and its presence in sufficient quantity to run down over chin and clothes is suggestive of suspension during life, or at any rate immediately after death, for the secretion ceases soon after cessation of the circulation. It must be remembered, too, that the pressure of the rope on the salivary glands may have some effect on this secretion. A state of erection or semi-erection of the genital organ has also been frequently noted, with or without expulsion of semen, but it has no reference to the precise nature of the death. *Post-mortem* lividity is most marked in the legs, and occasionally a number of ecchymoses may be seen on the skin. Taking the general external appearances as a whole, while they *may* suggest a violent asphyxial death, there is more commonly nothing about them to suggest such a thing with just one exception, viz., the position of the body in its relation to the head, which is most important ; thus, owing to the relative position of fulcrum and weight, the head is bent in the direction in which the combined action of gravity and suspension would carry it and stiffened in that position. The early or late appearance of *rigor mortis* is quite immaterial, but if the head is found hanging over in this position it proves that the hanging took place before *rigor mortis* set in or after it had disappeared from the neck ; and if the *rigor mortis* has disappeared from the neck and so allowed it to hang in this position, while the rest of the body is stiff, the circumstance is suggestive of hanging by a murderer to simulate self-destruction.

General Internal Appearances. Internally we find the appearances described under " Asphyxia," *i.e.*, engorgement of the lungs and venous system generally with dark-coloured fluid blood. Subpleural ecchymoses are frequently seen. The mucous membrane of the windpipe is more or less congested, and has been observed on one or two occasions to be covered with a fine bloody mucous froth. This may be due to imperfectly obstructed respiration, with spasmodic efforts at breathing. The right side of the heart, and the great vessels connected with it, are commonly distended with blood. But when the inspection has been delayed for several days, this distension may not be observed. When made before *rigor mortis* has set in, all the cavities of the heart may be found engorged with blood. The vessels of the brain are generally found congested ; and in some rare instances, it is said, extravasation of blood has been met with on the membranes, or in the substance of the organ. Effusion of blood is, rare, however. In one hundred and six cases recorded by Casper it was not found in a single instance. In one case of death from hanging, Brodie found a large effusion of blood in the substance of the brain, and he refers to another case in which there was a considerable effusion between the membranes. The venous congestion of the cerebral vessels is, however, rarely greater than in other cases of asphyxia, and is probably dependent on the degree to which the lungs have become engorged (*vide* above, "Causes of Death," p. 585). In most instances there is increased redness of the substance of the brain, so that, on making a section of the hemispheres, a greater number of bleeding points than usual will appear. The kidneys have been found much congested. A more important circumstance has been noticed by Yelloly, namely, that in examining the stomachs of five criminals who had been hanged, he found great congestion in all, while there was blood coagulated upon the mucous membrane in two. Such an appearance might, it is obvious, be attributed in a suspicious case to the action of some irritant substance. In the case of Good, who was executed for murder, the stomach was found on inspection to present over its whole surface, a well-marked redness, resembling the effect produced by an irritant poison.

Special Examination of the Neck. *A*. **Externally.** It has been already mentioned that the head is commonly bent on the chest, though this, of course, varies with the position of the body in reference to the point of suspension and the position of the ligature. The neck in nearly all cases appears stretched, and will probably show the marks of the ligature. We say probably, because if a very soft ligature be used and the hanging period very brief, it is possible that the mark may be very slight. The actual **mark or marks of the ligature** must be carefully noted in regard to depth, direction, number, colour, excoriation, ecchymosis, width, pattern and position above or below the larynx.

Depth. It is commonly depressed, as might be expected from the pressure produced by counterpoise of body and ligature. If the body is completely hanging, the depth is likely to be proportionately greater from the increased weight.

Direction. The course of the mark is generally oblique, and it is often interrupted. If the noose should happen to be in front, the mark may be circular, the lower jaw preventing the ligature from rising upwards in the same degree in front as it commonly does behind. Obvious deductions may be made from this as to how the body was suspended, or rather in what position; and it may be important in deciding between homicide and suicide. The position of the knot may be indicated by an indentation or excoriation of the skin at one spot.

Number. If there is more than one distinct mark, this must be noted for its bearing on "homicide *v*. suicide." An interrupted mark must not be mistaken for multiple marks; if the actual ligature is available, it may be applied to decide the point.

Colour. It is frequently free from all traces of discoloration as the result of ecchymosis, the skin in the depression being then hard, brown, or of the *colour and consistency of parchment*; or there may be only a thin line of blue or livid colour in the upper or lower border of the depression, and chiefly in front. In some instances the mark, instead of being livid or brown, has presented itself simply as a white depression (*vide* " Hypostases and Pressure," p. 181).

Excoriation. If the epidermis has been rubbed off, a parchment-like mark will be seen. This is very important as a guide to the nature of the ligature, and the degree of violence. Excoriation is quite commonly absent. The parchment appearance is seen some hours after death from drying of the part, and does not represent a vital phenomenon.

Ecchymosis. Actual bruising is not common in suicide, owing to the absence of violence. The width and softness of the ligature may also obviate ecchymosis ; when present, the hæmorrhages are seldom continuous along the mark.

Width. This has an obvious bearing on the nature of the ligature, a piece of string, for instance, producing a narrow and deep depression, while a strap would produce a much wider one.

Pattern. It occasionally happens that an actual pattern or impression of the material used is left on the skin. It is very important, therefore, to note if such be the case.

Position. Medical jurists have considered it proper to inquire into the position of the cord or ligature, as this may sometimes form a question in cases of suspected murder by hanging. The following table shows that in more than four-fifths of all cases of *suicidal* hanging, the ligature is found encircling the neck between the chin and hyoid bone :—

	Remer.	Devergie.	Casper.	Totals.
Above the larynx	38	20	59	117
On the larynx	7	7	9	23
Below the larynx	2	1	0	3
	47	28	68	143

If the body is only partially suspended, there is a greater tendency for the noose to take a lower position in the neck.

B. **Internally or on Dissection.** Marks of rupture of blood vessels, muscles, tissues, etc., may be seen.

Ecchymosis. It was formerly believed that the impression produced by the ligature was invariably discoloured from effusion of blood, or ecchymosed, but more correct observation has shown that this condition is an exception to the general rule. When ecchymosis does exist, it is commonly superficial and of slight extent. In the bodies of persons who have been judicially executed, it is not unusual to find ecchymosis, but even there it is not always present. In a case examined by Taylor, there was only a slight trace of ecchymosis in one spot where the knot in the cord had produced contusion. That it should occur in criminal executions is not surprising, considering the violence employed on these occasions,[1] but it has been somewhat too hastily assumed that the appearances found in executed criminals are met with in all cases of death from hanging. The mark is not infrequently a mere identation on the neck without even any abrasion of the cuticle or ecchymosis, the tissues underneath being bloodless from pressure. The matter may thus be summed up from modern knowledge: If the violence to the neck has been sufficient and applied sufficiently roughly to rupture small blood vessels, then there will be ecchymosis, and the greater this ecchymosis the greater the probability that life was present at the time of hanging; if, on the other hand, the violence has been gradually and quietly applied, there will be less chance of ecchymosis, even if the person was suspended while still alive.

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[1] In some countries executions are judical strangulations with brutal violence hence foreign observers see ecchymosis frequently.

Injuries to Arteries and Muscles. Injuries to the muscles and deep-seated parts of the neck are only likely to be seen when considerable violence has been used in hanging. In several instances the lining membrane of the common carotid artery has been found lacerated. Injury to the carotid arteries is a valuable sign in hanging and strangulation. These arteries may be injured by the ligature when the artery is sufficiently stretched and squeezed. The injury consists partly in a rupture of the inner and middle coats, partly in extravasation of blood from the vessels of the walls of the carotid artery. Friedberg is of opinion that the stretching of the vessel has more to do with bringing about the lesion than the squeezing, and in support of this view, adduces cases where the rupture of the arterial coats was situated at a distance from the site of the ligature. The seat of the rupture is not always one or both common carotid arteries: the right external carotid artery was observed to be injured in a case of suicidal hanging, the ligature lying between the hyoid bone and the larynx. The stretching of the artery necessary for the rupture of the vessel may be caused by the drop suddenly increasing the pull upon the ligature through the weight of the body, or by the movements of the body directed towards freeing the neck from the noose. The rupture of the vessel may be produced by suspension of the corpse after death, but extravasation of blood is a vital phenomenon, and thus becomes a valuable sign pointing to suspension during life.

Injuries to the Spinal Column and Cord. These are commonly found only in judicial hangings, but they might occur in a determined suicide if he threw himself off a height after the application of a rope.

Fractures of Larynx and the Hyoid Bone. These injuries have been recorded by various observers, but they are rare in hanging. They are, however, frequent in strangulation when much violence is used (*vide* "Strangulation," p. 560 *et seq.*).

We must now consider the medico-legal questions that arise in a case of hanging. These we shall consider in the following order:—

1. Was death due to hanging, or was the body suspended after death ?
2. Was it accident, suicide or homicide ?

Was Death due to Hanging, or was the Body hanged after Death ?

When a person is found dead and his body suspended, it may be a question whether death really took place from hanging or not. In investigating a case of this kind, it is necessary to draw distinction between the *external* and *internal* appearances of the body. The former alone may be sufficient for returning an answer to this question; the internal appearances of the body may furnish the general signs of asphyxia, and enable us to say whether any latent cause of death existed or not. Both of these points are of extreme importance, so that it must not be supposed that a most thorough autopsy can be dispensed with.

The Mark of the Cord. Among the external appearances, it is chiefly to the *mark* produced by the cord on the neck that medical witnesses have looked for the determination of the question. As the form, position, and other characteristics of this mark have been already described, it will now be necessary to allude to it only as furnishing evidence of life at the time of its production. It has been stated that, so far from being constantly livid or ecchymosed, this condition is, in reality, not seen in more than one-half of the cases which occur. But admitting that we find ecchymoses in the course of the ligature, are we always to infer that it must have been applied while the person was living? The answer to this is simply as follows: The greater the effusion of blood the greater the probability that circulation (and life) was proceeding at the time; if there is no effusion, it is impossible *from the mark alone* to say whether the body was alive or dead when suspended.

A microscopic examination of the tissues should be undertaken in order to observe whether extravasation has actually occurred and whether blood has been forced into the tissues indicating that the circulation was active at the moment of suspension.

Sometimes, besides ecchymoses, there are abrasions of the skin in the course of the cord, and these are known to have been produced during life by the effusion of blood which accompanies them.

The depression made by the ligature may be hard and brown, although it does not usually acquire this colour until some hours have elapsed after death. It depends upon a drying of that portion of the skin which has been compressed or condensed by the ligature. Sometimes the upper and lower borders only of the depression present a faint line of redness or lividity; and it is worthy of remark that when the ligature presents any knots or irregularities, those portions of the skin which sustain the greatest compression are white, while those which are uncompressed are found more or less ecchymosed. It is in this manner that the form of a ligature is sometimes accurately brought out. It may be remarked of the parchment-like appearance of the depressions produced by the cord that the characters which they present are the same, whether the hanging has taken place during life or soon after death; *i.e.*, the appearances may be similar in the two cases.

Effects of hanging a Dead Body. The following are the results of experiments performed by Casper.

1. The body of a man, *æt.* 28, was suspended, an hour after death, by a double cord passed round the neck above the larynx. The body was cut down and examined twenty-four hours afterwards. Between the larynx and hyoid bone there were two parallel depressions, about a quarter of an inch deep, the skin having a brown colour with a slight tinge of blue, and a leathery consistency: in certain parts it was slightly excoriated. There was no effusion of blood beneath, but the muscles which had undergone compression were of a dark purple colour, and the blood-vessels of the neck were congested. The appearance of the body was such that any person unacquainted with the facts would have supposed, on

looking at it, that the hanging had really taken place during life, for there was nothing to indicate that the body had been hanged an hour after death. 2. The body of another young man was hanged an hour after death, and an examination was made the following day. The two depressions produced by the double cord were of a yellowish brown colour, without ecchymoses; the skin appeared as if it had been burnt, and felt like parchment. 3. The body of an old man who had died from dropsy, was hung up two hours after death. The impressions presented exactly the same characters as in the preceding case. When the hanging took place at a later period than an hour after death, there was no particular effect produced.

We learn from these experiments, as well as from those performed by other observers, that the mark which is usually seen on the neck where hanging took place during life (non-ecchymosed) may be produced also by a ligature applied to the neck of a subject *within two hours*, or even at a later period, after death—consequently, the presence of this kind of mark on the neck is not conclusive proof that the hanging took place either during life or after death. The changes in the skin beneath the mark are also devoid of any distinctive characteristics: there is the same condensation of the cellular tissues whether the hanging has occurred in the living or in the dead body. These changes are merely the result of mechanical compression.

Summary of Medical Evidence from Cord Marks. From the foregoing considerations we draw the conclusion that there is no certain and constant sign by which the hanging of a *living* person can always be determined from an inspection of any dead body. The external marks may be simulated to a greater or less degree in a *dead* body, and the internal appearances do not always furnish characteristic evidence. Still, when the greater number of the signs enumerated are present, and there is no satisfactory cause to account for death, we have strong reason to presume that the deceased died from hanging. Medical evidence must not be ignored, merely because plausible objections may be taken to isolated portions of it. Facts may show that, however valid such objections may be in the abstract, they are wholly inapplicable to the particular case under investigation. Perhaps the greatest difficulties occur in connexion with cases of *suicide*, owing to the slight appearances which usually attend this form of death; but on these occasions moral and circumstantial proofs are usually forthcoming so that in many cases the coroner decides to dispense with a medical inspection of the body. If, then, it is not in all cases possible to distinguish hanging in the living from hanging in the dead, this must apply also to cases wherein persons commit suicide, and not only to cases in which they are killed by others. Even if a doubt were raised in any particular instance, it is more than probable that circumstantial evidence would furnish grounds for a decision, and thus satisfactorily compensate for the lack of strict medico-legal proof. If when a deeply ecchymosed or livid mark is found around the neck of a dead person, it may usually be alleged with confidence, other circumstances being equal, that the person had died by hanging, as it would be only a murderer who would think of hanging up a recently dead body to simulate suicide, in such a case there would be some obvious indications about the body that death had been caused by violence. The absence of such indications and the presence of ecchymosis in the course of the cord, would enable the question of hanging during life to be determined in the affirmative. In cases in which there is no ecchymosis in the seat of the ligature caution should be exercised in expressing an opinion that hanging took place after death. Many facts show that numerous cases of hanging during life would be pronounced to be cases of hanging after death, if the mere absence of ecchymosis in the course of the cord were taken as the determining factor. The discovery of marks of violence on the body is not of itself sufficient to rebut the presumption of death from hanging. The violence should at least be of such a nature as to account for the immediate cause of death or it can throw no light upon the question whether the person might not have died from hanging, in spite of the marks of maltreatment found upon the dead body.

If, in connexion with a body found hanging, a medical witness should assert that death had *not* taken place from this cause, this would be tantamount to declaring that the deceased must have been murdered—because it is difficult to suppose that anyone but a murderer would have any motive for hanging up the body of a person recently dead. Hanging after death has been frequently done with the object of concealing the real cause of death, and of making the act appear to be one of suicide.

Violence or other Possible Cause of Death. Cases have frequently occurred in which suicides have inflicted very serious wounds upon themselves and then completed self-destruction by hanging, so that hasty conclusions must not be drawn. When a body is found hanging with serious wounds upon it, then it must be decided whether the victim was able to hang himself after these wounds were inflicted (*see* pp. 305 and 311).

The following cases admitted of no doubt :—

A woman was found suspended to a beam in a barn. Owing to the absence of the usual marks of hanging about the face and neck of the deceased, a careful examination of the body was made. In the course of the inspection, a small penetrating wound, evidently inflicted by a round instrument, was discovered on the right side of the chest, but in great part concealed by the breast on that side. On tracing the wound, it was found to pass between the fifth and sixth ribs, completely perforating the heart from right to left. A considerable effusion of blood had taken place internally, which had been the cause of death. It was therefore evident, from the result of this inspection, that deceased had been killed, and her body suspended after death.

Fodere refers to a case in which a person was found hanging in somewhat similar circumstances, and on examination it was discovered that death had been caused by the administration of poison—the body having been subsequently suspended.

There are, however, cases of this kind in which some embarrassment may occasionally occur. It may be a question whether the discovery of poison in the body of a person found hanging is consistent with a previous attempt at suicide by poisoning. In one case a person hanged himself after he had swallowed a strong dose of prussic acid.

The two following cases show the importance of making *post-mortem* examinations of those whose bodies are found hanging. The first was the case of a woman whose body was found suspended. It was discovered on inspection that there was a rupture of the stomach, from which the woman had died. The body was hung up by the husband soon after death. In the second case, a man confessed that he had killed his wife by a blow with his fist, and that afterwards he had hung the body up to simulate death by suicide.

Was it Accident, Suicide, or Homicide ?

Accident. Accident is very uncommon ; we may dismiss it with a few examples without much discussion, inasmuch as the circumstances surrounding any such case are nearly certain to clear up the matter.

The death of Scott, the American diver, shows how readily asphyxia may be induced by a slight compression of the throat, even when a person might be supposed to have both the knowledge and the ability to save himself.

This man was in the habit of making public exhibitions on hanging, and had frequently gone through them without harm ; but on this fatal occasion, it is probable that a slight shifting of the ligature from under the jawbone caused so much compression on the throat between the chin and larynx as speedily to produce asphyxia. No attempt was made to save him until it was too late, and he was not brought to a hospital until thirty-three minutes had elapsed. He was allowed to hang *thirteen minutes*—the spectators being under the impression that the deceased was only prolonging the experiment for their gratification.

A girl of thirteen was hanged by accident. She was swinging in a brewhouse, and near the rope used by her was another for drawing up slaughtered sheep. In the course of the exercise, her head got through a noose of this second cord, which pulled her out of the swing, and kept her suspended at a considerable height until she was dead.

A child of ten had been amusing himself by swinging from a piece of plaid-gown fastened to a loop in a cord, which was suspended from a beam. In the act of swinging, he raised himself up and gave himself a turn, when the loop of rope suddenly caught him under the chin, and suspended him until life was extinct. Another boy who was in the room did not give any alarm for some time, thinking that the deceased was at play.

A man who was in the habit of doing gymnastics on the rope, was one morning found dead and suspended in his bedroom. The rope had passed twice around his body and once around his neck, whereby it had caused death, although the legs of the deceased were resting on the floor. There was no doubt that the deceased had been accidentally hanged.

These are a few among many instances, and it will be seen that the circumstances in which they occurred were sufficiently indicative of the manner in which the hanging took place. Indeed, circumstantial evidence nearly always enables it to be determined whether the hanging was accidental or not.

In *R.* v. *Montague*, Mrs. Montague, who, though apparently a strict disciplinarian, had no motive for or intention of hanging her child, was charged with causing its death by hanging. She had tied the child's arms with a stocking fixed to a string, which, in turn, was fixed to a ring in a cupboard ; in some extraordinary way the stocking slipped up to and around the neck of the child. The absence of motive for killing was considered by the jury such a strong point in her favour that they gave her the benefit of the doubt, and reduced the charge of murder to one of manslaughter.

An alderman was found dead near his residence. He was seen on the previous night at his garden-gate alive, smoking a cigar, and was discovered near a coppice drive. down the embankment of which he had apparently fallen, with his neck jammed between the forked branches of a tree and his legs suspended up the embankment. He was unable to extricate himself and was suffocated.

Suicide v. Homicide

In dealing with this question, the competence of the medical witness to weigh all the factors of the case will be tested. It is not the duty of the medical witness to decide whether a man has hanged himself, or has been hanged by another, but merely to state, when required, the *medical circumstances* which support or rebut the one or the other suggestion. The factors to which consideration should be given are all or some of the following :—

1. Statistics.
2. Circumstantial evidence as to time, place, and opportunity.
3. The nature of the ligature and its method of application.
4. The marks of the ligature.
5. Wounds and other injuries.
6. Tying or fixing of the limbs.
7. Difficulty of self-suspension from physical deformity or defect.
8. Position of body.
9. Circumstantial evidence, including signs of a struggle.
10. General remarks on homicidal hanging.

1. **Statistics.** These are interesting and may be suggestive as far as they go (*vide* Table, p. 257), from which we may conclude that murder by hanging is very rare, but that suicide by hanging is common and has been known to take place at all ages, from youth to old age. The discovery of a person dead from hanging is presumptive of suicide, all other circumstances being equal. According to Indian authorities, by far the greater number of Indians who commit suicide hang themselves. Chevers[1] states that the criminals in India are well aware of the great prevalence of suicide by hanging, and after killing their victim by blows, they often suspend the body in order that the death may be attributed to suicide.

2. **Evidence of Time and Place.** These are very obvious factors in the case. A murderer is unlikely to choose either time or place at which he is likely to be interrupted or be observed. A suicide might be equally careful, it is true, but there may then be other circumstantial evidence such as doors and windows locked and fastened on the inside, etc.

3. **Nature and Method of Application of Ligature.** This should be carefully observed. Suicides usually take the material that is most accessible—braces, handkerchiefs, etc.—or there may be evidence to show where the material came from and how it reached the place where it was found. Here there is, too, room for evidence of premeditation in the fixing of the point of suspension. For the evidence derivable from knots and their nature, the number of turns in the ligature, etc. (*vide* " Strangulation.")

A young man who was arrested on a charge of deserting his wife and children, committed suicide in a cell at Hove police-station, by hanging himself with a piece of lining from his coat, which he suspended from the bell-handle. A verdict of suicide was returned, there being no evidence to show the state of mind.

The wife of a publican was found lying dead on the floor. Apparently she had hanged herself with a piece of tape upon a peg behind the bar door, and the peg had broken after death had taken place.

4. **The Marks of the Ligature and Injuries to the Neck.** It has been asserted that from the nature of the mark made on the neck by the cord, it is possible to determine whether the hanging was homicidal or suicidal. For example, if the mark is circular and situated at the lower

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[1] "Med. Jurisprudence for India."

part of the neck, this is said to be conclusive proof of murder. In hanging, the mark of the cord is generally *oblique*, being higher at the back part of the neck, in consequence of the loop formed by it yielding more in this direction than in front. But it is erroneous to conclude that this lack of obliquity in the impression can afford any proof in support of a homicidal act. Its form will depend in a great degree upon whether the body was supported or not, for it is the weight of the body which causes the mark and the direction of the *pull* which causes its direction ; it will also depend on the manner in which the cord is adjusted. Equally ill-founded is the assertion of Mahon, that the existence of *two impressions* on the neck affords positive proof of homicide. One of these impressions may be at the lower part of the neck, and circular—the other at the upper part, and oblique ; on these grounds it is contended that the deceased must have been strangled in the first instance, and afterwards hanged. The possibility that the suicide had made a prior attempt to strangle himself and thus to produce the mark, is often overlooked. There are facts on record which oppose this very positive statement.

A woman of unsound mind committed suicide by hanging herself, and on her neck two distinct impressions were seen—the one circular, the other oblique. These appear to have arisen from the fact that the cord was passed twice around the neck, the body being at the same time partially supported.

In some instances homicidal interference may be inferred if there are two distinct impressions, but such impressions alone could not establish the fact of murder.

A woman was found hanging from the branch of a tree with her feet resting on the ground. There were two marks on the neck, one suggestive of strangling with the same ligature as that by which the body was hanging. Walter concluded that the mark produced by the suspension of the body was the result of *post-mortem* hanging after murder by strangulation. In another case, a boy, *æt.* 9, was found hanging. There were marks of pressure on the neck which at first led the medical examiners to draw the inference that the boy had been strangled, and afterwards hanged. The reasons for this opinion were not satisfactory, and suicide was admitted to be not only possible, but probable.

The injury done to the neck by the cord or ligature can rarely afford any clue to the manner in which hanging took place, unless the circumstances in which the body is found support the suggestion of homicide, or suicide. Thus the laceration of the muscles and vessels of the neck, the rupture of the windpipe, and the displacement of the larynx, the stretching of the ligaments of the spine, and effusion on the sheath of the spinal marrow, may be observed in suicidal as well as in homicidal hanging. The presumption, however, is obviously in favour of the latter when these violent injuries are accompanied by fracture or displacement of the vertebræ of the neck, and the body of the deceased is not corpulent, the ligature by which he is suspended is not of a nature likely to produce them, and the fall of the body has not been great. As a rule, a long drop in suicidal hanging is rare.

An inquest was held in a case of suicidal hanging in which the deceased had fixed the rope to the top of a beam in a lofty barn, and had given himself a drop of about fifteen feet. The face of the corpse had an expression of the most horrible agony, and the tongue was protruded and bitten.

Injury to the Vertebræ of the Neck. A much-disputed question has arisen in medical jurisprudence whether the vertebræ of the neck can become fractured or displaced in *suicidal* hanging. Most medical men deny the possibility of this condition—the displacement or fracture of these vertebræ being observed only in judicial executions, when a long drop has been used by the executioner.

Upon inspecting the body of a woman who had hanged herself, extravasated blood was found behind the first two vertebræ of the neck, which were more widely separated behind than usual. On removing these vertebræ, the posterior ligament of the spine was found ruptured, and the transverse ligament of the first vertebra (atlas), so stretched that the process of the second was completely blocked against the articular surface. The perpendicular and oblique ligaments were entire. The deceased was a stout, healthy woman ; when discovered, her body was suspended from a beam, the feet being about a foot and a half from the floor. She had evidently fallen with considerable force.

This case will serve to show that severe injury to these deep-seated regions of the neck may be occasionally met with in suicidal hanging.

In another case of obvious suicide, the deep muscles over the second and third vertebræ of the neck were ecchymosed ; this ecchymosis extended to the sheath of the spinal marrow ; and on the left side, and externally to the sheath, there was a large effusion of firmly coagulated blood. There was no displacement of the second or other vertebra, and the ligaments were sound ; but between the third and fourth vertebræ there was unusual mobility, as if they had been stretched. In this case the body was not heavy, and the fall, if any, could have been but trifling. The effusion on the spinal marrow was the cause of death ; and its origin was sufficiently explained by the falling back of the head and sudden bending of the vertebræ of the neck. Her husband and family were in an adjoining room, but heard no noise ; it was only by accident that the deceased was discovered.

For further remarks *vide* " Strangulation."

5. **Wounds and other Injuries.** So far as these concern actual death by hanging, they have been already noticed (*supra*, p. 595). For our present inquiry, the presence of marks of violence on the body of a hanged person is important, and it is necessary that a medical witness should notice accurately their situation, extent, and direction. Having satisfied himself that they must have been received during life, he will have to consider the probability of their being of accidental origin or not. These marks of violence are not always to be regarded as furnishing unequivocal proofs of murder ; for it is possible that they may have been produced by the deceased himself before hanging, and having failed in committing suicide by such means, he may subsequently have decided to hang himself. A hanged person may bear the marks of a gunshot wound, his throat may be cut, his body lacerated or disfigured, and yet, before a suspicion of homicide is allowed to be entertained, it ought to be clearly established that such injuries could not, by any probability, have been self-inflicted. The importance of observing caution in such a case will be still more manifest when there is no ecchymosis produced by the cord, and the face does not present the marked features of hanging.

Marks of violence on a hanged person may occasionally be due to *accident.* If the person has precipitated himself with violence from a chair or table, he may have fallen against articles of furniture, and thus have caused lacerations and bruises. The rope may have given way, and the person in falling may have injured himself; but he may afterwards have succeeded in suspending himself again. Such an occurrence may be rare; but when the presence of these injuries is made to form the chief ground of accusation against another person, their possible accidental origin ought not to be lost sight of. The falling of a body on a hard pavement may produce such accidental injuries as might be wrongly attributed to homicidal violence. In death from asphyxia the blood remains fluid in the body longer than in other cases, so that accidental wounds after death may be attended with comparatively large effusions of blood. This is a result supported also by the general congestion of the venous system. Severe injuries may be found on the head of the deceased, and yet these may not be inconsistent with suicidal hanging.

If we suppose the deceased to have been hanged in a state of intoxication or stupefaction, medical evidence alone will rarely suffice to determine the question of homicide or suicide. The absence of all marks of violence from the body might actually diminish suspicion. On these occasions the hands of the deceased should be inspected, since it is with these that a person defends himself; and, unless taken unawares, it is almost certain, if the hanging were homicidal, that there would be traces of violence on these parts. The clothes would be torn and disarranged, and the general appearance of the body would be that of one who had done his utmost to resist a violent murderous attack. There might be some injuries which could not be attributed to accident in the circumstances. Among these may be enumerated fractures, dislocations, deeply penetrating incised and gunshot wounds. The question is—Do these serious injuries necessarily establish homicide? The answer must be in the negative, although when fractures or dislocations exist there are strong grounds for suspecting homicide.

A suicide may make more than one attempt to take his life and in more than one way.

A gentleman was found hanging dead. His clothing was much disordered; and some blood, which had issued from a deep wound in the throat, was found scattered over the floor. From the facts proved, there was no doubt that this had been an act of suicide, and that the deceased, previously to hanging himself, had attempted to cut his throat. Had his body been found in an exposed situation, this wound in the throat might have given rise to a suspicion of murder. A young man was found hanging in his bedroom, dead. He was suspended by his necktie, and his feet were within an inch of the floor. The door of the room was fastened on the inside, and it was proved that no one could have had access to it. An earthen pan was found near the bed, containing about a pint of blood, which appeared to have issued from a deep incision in the bend of the left arm of the deceased. The razor with which this had been inflicted was found on the mantelpiece.

It came out in evidence that on the previous night the deceased had swallowed a quantity of arsenic, and had suffered severely from the effects of the poison, although at the time it was supposed that his illness was due to other causes. In this case there were three ways in which suicide had been attempted. The deceased had first taken poison, then wounded and afterwards hanged himself. There could be no doubt that death was caused by hanging. Had the body been found hanging in suspicious circumstances, there might have been a strong presumption of murder.

A man was found hanging in a room by a cord attached to a nail in the ceiling. In the upper and fore part of the neck there was a deep wound, through which the cord had passed. A ladder was placed against the wall by the side of the body. About a pound of coagulated blood was found on the floor, as well as in different parts of the room, and some linen covered with blood was discovered near the body. In a table-drawer, in the room above, was found some cord sprinkled with blood, as if a bloody hand had been in contact with it. On the staircase between the two rooms there was no trace of blood. The deceased's room was secured on the inside by the door being bolted. The deceased's clothes were spotted with blood, and his hands were also bloody. The body externally did not present any ecchymosis or other mark of violence. The hands were likewise free from violence, the fingers contracted, and the nails blue. There were patches of cadaveric lividity scattered over the trunk, and the fæces had been discharged. The face had a slight violet tint, and the tongue, which had been forcibly compressed by the teeth, projected about an inch from the mouth. The wound in the throat was situated between the chin and hyoid bone, and extended from the angle of the jaw on one side to the opposite angle. It had penetrated through the mouth to the back of the throat, dividing only some small branches of the thyroid artery, and had evidently been inflicted after several attempts, for its edges were irregularly cut. The cord, in passing through the wound, had lacerated and extended it at the two extremities. The vessels of the brain were filled with blood, the vertebræ of the neck were uninjured, and the stomach was free from any trace of poison.

In this case the deceased had laid open his throat as far as the spine, dividing the right superior thyroid artery, by which so much blood had been lost that it was not unlikely that he would have soon fallen into a state of syncope. It is remarkable that he should still have had sufficient presence of mind and muscular power to do what the evidence shows he *must* have done—namely, to place a handkerchief to his wound to arrest the bleeding; to go upstairs to another room, and to search in a table-drawer for the cord with which he intended to hang himself; to place a ladder against a wall, and to make use of this for the purpose of fixing a cord to a nail in the ceiling—an act which could be performed only with great difficulty. In all these circumstances, it does not appear remarkable that homicide was suggested, and yet suicide was the only possible explanation of many of the facts and therefore of the death.

A woman was found hanging in her room. There were two penetrating wounds on the left side of the chest; these had perforated the pericardium, and touched the surface of the heart, without entering its cavities. There was a basin of bloody water, and a bloody sponge, on the table; the right hand of the deceased was stained with dried blood, and the door and window were fastened on the inside. This was a case of suicide, and after inflicting the wounds, the deceased had hanged herself. The mark on the neck was nowhere ecchymosed, but of a yellowish or parchment colour. There was nothing in the nature of the wound to have prevented self-suspension.

A woman committed suicide in the following circumstances:—She fastened a cord to the top of the bed-post, put her head in a noose while kneeling on the bed, made a deep wound in her arm with a razor, closed the razor, and put it aside. Becoming faint from loss of blood, she must have fallen forward, and the pressure of the cord on the neck caused death.

The remarks relative to incised wounds apply equally to gunshot wounds. A suicide may attempt to shoot himself; he may fail in the attempt, and ultimately hang himself. Any type of gunshot wound, provided that it is of such a nature that it did not immediately incapacitate or kill, may thus be found on a hanged person, and yet constitute no proof whatever of homicide. If there are facts relative to the wound which prove that it could not have been self-inflicted, this, of course, will affect the conclusion; but when such facts are not found, a medical witness should say, in answer to inquiries respecting the origin of these wounds, that they may have been inflicted either by the deceased himself or by *another*. There might be no medical facts which would directly establish either view. In one instance of suicidal hanging there were lacerated wounds upon the head, and a handkerchief was found blocking-up the mouth. If, in any case, the wounds or injuries are of a mortal nature, and probably caused rapid death, the presumption of murder almost amounts to certainty; for who but a murderer could or would suspend the dead body of a person so wounded, *immediately* after death?

6. **Tying or Fixing of the Limbs.** The hands or legs, but more commonly the former, have been found tied in cases of undoubted suicidal hanging; and yet it has been debated whether it was possible for a person to tie or bind up his hands and afterwards hang himself. It is unnecessary to examine the arguments which have been urged against the possibility of an act of this kind being performed, or indeed to quote any cases; they are so common. Full consideration must be given to the question of how they are tied—material, knots, etc., before a definite conclusion is arrived at (*vide* p. 574).

Suicides sometimes designedly arrange matters so as to create a suspicion of murder.

In one case a man succeeded in tying his arms together at the wrists, and then passed his lower limbs and body between the arms, so that the hands were now tied together over the buttocks. He then, by stepping on to a chair, passed his head through a noose, and hanged himself.

7. **Difficulty of Self-suspension from Bodily Deformity or Defect.** It has been a debated question whether *bodily infirmity*, or some deformity affecting the hands, might not interfere with the capacity of a person to hang himself. This question can be decided only by reference to the special circumstances of each case. In the case of the Prince de Condé, it was alleged that he could not have hanged himself, by reason of a defective condition of one hand; it was also said that he could not have made the knots in the handkerchiefs by which he was suspended. Allegations of this kind appear to have been too hastily made in this and other instances. Determination of purpose will often compensate to a great extent for bodily infirmity; and unless full allowance for this is made there is a danger that a wrong conclusion may be arrived at. Blindness is no obstacle to this method of committing suicide, and in reference to *age*, suicide by hanging has been committed by a boy of nine, and by a man of ninety-seven years of age.

8. **Position of the Body.** It may be stated that no evidence as to murder or suicide is obtainable from the position of the hanging body unless it is found hanging in a position in which the deceased could not have placed himself. For example, if the body is completely suspended, there must, in a case of suicide, be some object, such as a table or chair, from which the deceased stepped, or it must be possible to show that he could have placed his head in the noose without standing on a support. Where the body is partially suspended in an unusual position with the feet on the ground, there is a strong suggestion of suicide.

This matter was strenuously argued on the investigation which took place relative to the death of the Prince de Condé in 1830. The case requires a brief notice here, as it involves two glaring errors in medical evidence as to death from hanging: (1) that a person cannot die from hanging when the body is in any way supported, and therefore that murder must have been perpetrated; (2) that in all cases of death from hanging the mark produced on the neck by the cord or ligature must be discoloured or ecchymosed.

On August 27th, 1830, the Prince de Condé was found dead in his bedroom partly dressed, his body being suspended from the fastening of the window-sash by means of a linen handkerchief attached to a cravat which he was in the habit of wearing. The head was inclined a little to the chest, the tongue was congested and protruded from the mouth; the face was livid, a mucous discharge issued from the mouth and nostrils, the hands were clenched, the toes of both feet touched the floor of the room, the heels were elevated, and the knees were partly bent forward. The point of suspension was about six and a half feet from the floor. The legs were uncovered, and had some light abrasions upon them. There was a chair near the deceased. There were no marks of violence about it beyond those which might have been produced accidentally by the chair in the act of hanging. There was no natural cause of death in the body, nor any appearance to indicate that there had been violent struggling or resistance on the part of the deceased. On the upper and lateral part of the neck there was a mark produced by the ligature, but no ecchymosis; and on the left side of the neck, corresponding to the knot of the cravat, there was a depression somewhat deeper.

The case involves only the ordinary details of suicidal hanging. It was contended, however, that he had been strangled by assassins, and his body afterwards hanged. The features presented by the mark on the neck, and the erect position of the body with the feet on the floor were the chief medical factors on which those who adopted the hypothesis of murder rested their case. The evidence obtainable from the mark on the neck has been elsewhere considered (p. 597); and with regard to the erect position of the body, all experience is against those who would treat this as negativing suicidal hanging. In order that death should take place from hanging, it is not necessary that the body should be freely and completely suspended.

Many cases have been recorded since in which death has taken place from hanging where the feet were in contact with the ground, or the persons were almost sitting or recumbent.

The reports of eleven cases of suicidal hanging or strangulation gave the following results: in three the bodies were found nearly recumbent; in four in a kneeling posture, the body being more or less supported by the legs; and in four the persons were found sitting. In one case the deceased, a prisoner, was found hanging to the iron bar of the window of his prison, which was so low that he was almost in a sitting posture. The ligature which he had used, was a necktie, but (what was more remarkable in the case), the hands of the deceased were found tied by another handkerchief. The body was warm when discovered. There was no doubt that this was an act of suicide; yet, if the body had been found in an unfrequented spot, the discovery of the hands *tied*, if not the position, would have led to a strong suspicion of murder. In his position the deceased had succeeded in tying his hands together by means of his teeth.

Further evidence need not be adduced to show how unfounded is the popular notion that the hanging is homicidal in cases where a body is loosely suspended, or in which the feet are in contact with any support. On the contrary, these facts should be regarded as evidence against homicide; for there are probably few murderers who would suspend their victims, either living or dead, without taking care that the suspension was not partial, but complete. Besides, the facts of many of these cases are readily explicable; thus, if the ligature is formed of yielding materials, or if it is only loosely attached, it will yield to the weight of the body after death, and allow the feet to touch the floor, which might not have been the case at first. If there is reason to believe that the body has not altered its position after suspension, we must remember the rapidity with which insensibility usually takes place and death ensues in this form of asphyxia.

9. **Circumstantial Evidence including Signs of a Struggle.** In all doubtful instances, circumstantial evidence is important. We should observe whether the doors and windows of the rooms are secured on the inside or on the outside ; whether the clothing of the deceased is at all torn or disarranged, or the hair dishevelled ; whether the attitude of the body is such as to show interference after death ; whether there are marks of blood about the body, on the ligature, or in the room ; whether the hands are bloody, or present marks of wounding, or of a struggle ; whether the rope or ligature corresponds to the impression seen around the neck ; and last, whether the cord is of sufficient strength to support the weight of the deceased. The strongest evidence of homicide is often found in the position and the state of the clothing ; it may or may not indicate interference or change after death irreconcilable with the suggestion of death from suicide or accident. On this point the minutest circumstances may become of considerable importance as medical evidence. When there are indications of a violent struggle, the clothing may be found disarranged, unless it has been smoothed or arranged by the murderer after the death of the victim. There may, of course, be no evidence of disorder or discomposure of the clothing when the body is freely suspended. These matters fall, it is true, more within the province of the police than of a medical practitioner ; but the latter is generally the first who is called to see the deceased, and therefore unless such facts are noticed by him on his visit, they may often remain altogether unrecorded. The medical opinion of the actual cause of death, however, must be based on *medical* facts alone, but circumstantial evidence has on various occasions assisted in clearing up a doubtful case. Louis states that, on removing the body of a man who was found hanging, the rope was observed to be stained with blood. This simple circumstance led to further investigation, by which it was discovered that the person had been murdered, and that the body had been suspended afterwards. The presence of marks on the neck, indicative of strangulation, which the cord was not likely to have produced may lead to a suspicion that the hanging followed death.

The body of a boy was found hanging. A round ecchymosed mark, about the size of a half-crown, was seen on the fore part of the neck ; and near it were several impressions, as of fingers and nails, in the surrounding skin. There was neither depression nor ecchymosis in the course of the cord. The inspection left no doubt that the deceased had died from asphyxia. The boy had been first strangled, and afterwards hanged.

The body of a man was found hanging in a room ; it was so suspended from a hook that the feet were not more than nine inches from the floor, and the legs were stretched out at length. The cord was from two to three feet long, and but loosely passed around the neck. The furniture of the room was in great disorder, and some marks of dry blood were seen on one part of the floor. The right side of the head and face presented several excoriated and ecchymosed marks. There was a circular impression around the neck, produced by the cord, but it was free from ecchymosis. On the left side, a little above this impression, there was a strongly ecchymosed mark, which could be traced around to the back of the head. Blood was found effused beneath this mark. The lungs presented the appearances of asphyxia, but the examiners considered this to be due to strangulation, and not to hanging, concluding that the body had been suspended after death in order to simulate suicide.

In this connection it must be remembered that insane persons may, with that cunning which is peculiar to the insane, throw a room into great disorder before committing suicide, and, moreover, as they may have made an attempt (prior to hanging), by cutting, blood may be scattered about the room ; every detail as to the amount and nature of such stains may be important.

10. **Difficulties in Homicidal Hanging.** It has been truly observed that of all the forms of committing murder, hanging is one of the most difficult, and it is therefore but seldom resorted to. In most cases, when a body had been hanged by a murderer, it has been after death, in order to avoid suspicion of homicide. Hence the discovery of a body hanging affords *prima facie* evidence of suicide, assuming it to be certain that death has taken place from this cause. A man may, however, be murdered by hanging without there being any evidence thereof from the condition of the body. The circumstances in which this conclusion may be founded are the following : (1) When the person hanged is feeble and the assailant a strong man. Thus, a child, a youth, a woman, or a person at any period of life who is worn out and exhausted by disease or infirmity, may be killed by hanging. (2) When the person hanged, although usually strong and vigorous, is at the time in a state of intoxication, stupefied by narcotics, or exhausted by his attempts to defend himself. (3) In all cases murder may be committed by hanging when many persons act in combination against one person (*e.g.*, lynching). With these exceptions, then, a medical practitioner will be correct in a suspected case, in deciding in favour of the presumption of suicide. Unless the deceased suffered from stupefaction, intoxication, or great bodily weakness, one would expect to find, in homicidal hanging, marks of violence on the body ; for there are few persons who would submit themselves to be murdered without offering some resistance. The following is a singular case of attempted murder by hanging :—

A woman, *æt.* 69, was charged with attempting to hang her husband, who was some years older. It appeared that the accused contrived to twist a small rope three times around the neck of her husband, while he was lying asleep. She then tied him up to a beam in the room, in such a manner that when the neighbours entered, he was found lying at length on the floor, with his head raised about one foot above it. He was insensible ; his hands were lying powerless by his side, his face was livid, and it was some time before he could be aroused. Had he remained longer in this position he would have died. According to his statement, he went to bed sober, and he was not aware of anything which had passed during the attempt to hang him or afterwards until he was resuscitated. The woman had no ill-will against her husband, and was herself at the time intoxicated. It seems hardly possible that any man should be so sound asleep as not to be awakened by the attempt thus made to hang him. The probability is that the husband was, like his wife, intoxicated and helpless.

A man named Eyraud, and a woman named Bompard, succeeded in hanging a man named Gouffé. The victim was enticed into an alcove for the purpose of an interview with Bompard, who had been his mistress. In the alcove, Eyraud was stationed behind a curtain, and a compound pulley with a rope and hook was so fixed that whilst Gouffé was sitting on a sofa with Bompard on his knee, she passed a silken cord round his neck, and then passed the free end of the noose, which was provided with an eye, to Eyraud, who slipped it over the hook and hoisted up Gouffé.

CHAPTER XVI.

SUICIDE

Although throughout all the sections of this work dealing with violent deaths the question whether the event was accidental, suicidal or homicidal has had to be considered, there has been no opportunity for considering the subject of suicide in all its bearings. It is here discussed under the following headings :—

Statistics.
Peculiar Methods of Suicide.
Suicide as a Felony.
Suicide in Persons of Unsound Mind.
Suicide and Insanity.
Suicide in Life Assurance.

STATISTICS

Return of Suicides (England and Wales)

1902–1906 average	3425	1927	4907
1907–1911	3608	1928	4882
1912	3608	1929	4984
1913	3514	1930	5051
1914	3724	1931	5108
1915	2966	1932	5707
1916	2855	1933	5602
1917	2495	1934	5501
1918	2765	1935	5184
1919	3348	1936	5043
1920	3425	1937	5125
1921	3759	1938	5280
1922	3876	1939	5039
1923	3949	1940	4882
1924	3720	1941	4153
1925	4084	1942	3803
1926	4494	1943	3846
		1944	3762

PECULIAR METHODS OF SUICIDE

We have repeatedly drawn attention to " evidence of design " as throwing light upon the question whether a given violent death were due to accident, suicide, or homicide. The following cases illustrate the question :—

A man determined to guillotine himself. He constructed an apparatus by which a heavy axe-blade was held in place by a can of water. In the bottom of the can was a hole which allowed the water to run out slowly, and when a certain amount had escaped, the axe-blade was liberated. The operator laid his head on some support, so that the axe would strike him on the neck, and placed a dish of ether in such a position that he would inhale it and so become unconscious before he was decapitated. The axe fell as he had intended. A strange attempt at suicide has been much quoted from this work. A man placed the point of a dagger against the skull in the frontal region and then drove it into his brain by a blow from a mallet. The blade, which was four inches long, was driven in up to the hilt ; but assistance came on the scene, and the dagger was ultimately removed, the patient making a perfect recovery. A still more peculiar method of self-destruction was adopted by a man who drove into his head two stone chisels, each being eight and a quarter inches long and three-eights of an inch in diameter, using for the purpose a wooden mallet weighing $2\frac{3}{8}$ pounds. One of the chisels was driven through the head from right to left, entering in the right temporal region and emerging in the left nearly in a direct line ; the other chisel was driven into the centre of the forehead, penetrating half an inch into the frontal lobe. After inflicting the injuries the man approached a glass door, through which he was seen by two persons. He tried to open the door, but failed. When the door was broken open he walked a distance of forty feet with but little aid, and was able to talk. The chisels were withdrawn with much difficulty, and he died about five hours afterwards. A man committed suicide by placing a dynamite cartridge in his mouth, lighting the fuse, and then awaiting the explosion. Although much injury to the surrounding parts naturally ensued, the man lived for two hours afterwards.

A case of suicidal drowning took place by simply plunging the head into a basin of soup ; and in another case a woman broke the ice on a pond, thrust her head through the hole, and so perished.

Death from strangulation by hanging is common, but sometimes a noose is used in a different way, the active strength of the suicide supplying the force that is usually supplied by his passive weight. An insane patient succeeded in ending his life by strangulation of this sort. The body was found lying on the back with the right foot pressed against a bed-post. Around the neck was a loop-knot made of a bed-sheet torn in two, one end of which was attached to one of the bed-posts. The deceased, by pressing his foot against the opposite post had drawn the noose tight, and so maintained it, thus causing strangulation.

Suicides occasionally select particularly painful means of ending their lives.

A man suffering from melancholia was seen with a red-hot iron rod, about two feet in length, the cool end of which was against the wall and the heated end against his abdomen. He was interrupted in this attempt, but not long afterwards he made the iron white-hot and succeeded in thrusting it four or five inches into his abdomen. In yet another case the dead body of a man with extensive burns was found lying on an iron bedstead. A burnt candle was beneath the bedstead. From papers in the room it appeared that the man wished to prove that suicides were not cowards, and he had adopted the following awful method of terminating his life in order to prove his theory. He had lain on the bed over the lighted candle, rising from time to time to record his sensations, and then resuming his position on the bed.

A man, aged sixty-three years, who had previously complained of pains in the head and body, committed suicide by cutting through the back of his neck with a razor in a terribly resolute manner. The man was found in a corner of his bedroom seated on a low trunk with his head resting against the wall. A blood-stained razor, lying open, was close to him. An examination of the body and its surroundings revealed nothing suggestive of foul play ; on the contrary, the hands afforded strong confirmatory evidence that the wound had been self-inflicted. Examination of the wound showed that three separate attempts had been made. The first incision passed from left to right through skin and fascia without wounding the underlying muscles. Starting from a point one inch below the left mastoid process, and half an inch above the level of the transverse processes of the seventh cervical vertebra, it passed in a slightly upward direction to a point a quarter of an inch below and three-quarters of an inch behind the angle of the jaw on the right side, here tailing for a quarter of an inch. The second incision, unlike the first, passed from right to left. It began from a point one inch behind the digastric groove (right side), dividing both skin and fascia for half an inch ; then, entering the wound made by the first incision, it cut partially through the trapezii and splenii, becoming superficial at a point a quarter of an inch behind the lobe of the left ear, and tailed for one-eighth of an inch. The third incision started from below the right mastoid process, descended for a quarter of an inch to meet the first incision, and then passed from right to left deeply through all structures to the interval between the atlas and the axis. Entering the spinal canal in that interval, it opened up the theca vertebralis and slightly wounded the posterior columns of the cord, and having notched the transverse process of the axis (on the left side) became superficial by passing below the lobe of the left ear with a tail carried across the left cheek to the anterior border of the masseter. The whole three incisions were made by the razor while held in the *right* hand— no easy task to accomplish. Because of the regional anatomy of the parts, hæmorrhage was only slight, and death could not be attributed to loss of blood. The shock caused by the rapid loss of cerebrospinal fluid is probably a factor of more importance. No dislocation of the vertebræ took place, so that there was no pressure on the cord from this cause.

If the circumstantial evidence proving suicide is reliable, this case must be unique so far as regards the nature of the injuries, for it shows how sure of his ground a medical witness should be before he swears that any wounds of the throat are definitely homicidal.

The following cases are of interest in the same connection :—

A young woman jumped from the suspension bridge at Clifton and fell about 300 feet ; her clothing acted as a sort of parachute, and she was picked up alive and none the worse for the fall except for a few bruises. She remembered nothing of her actions. A man has been known to swim across a river in order to throw himself under a train. Occasionally, however, extraordinary methods have been chosen. More than one case is on record in which the entire larynx had been self-removed.

A lad who was a patient in the same ward as the deceased, noticed that the deceased had been acting strangely. There were movements under the bed-clothes as if he were stabbing himself in the abdomen, and he subsequently pulled the clothes up level with his eyes and seemed to be injuring his face. On examination, a wound eight inches long was found in the abdomen, and an incision seven inches long on the left side of the neck. He died the same night.

Suicide by hanging has occasionally been carried out in bed. A case is recorded of a girl who thus killed herself by merely securing a cord to the frame of the bedstead and then leaning back in bed, the tension so produced being sufficient to cause the necessary constriction of the neck. Two other girls who were sleeping in the same bed were not awakened.

Another strange case is that of a woman who laid herself on a bed, attached the running noose of a rope around her neck, tied the other end of the rope to a heavy piece of metal, which she threw over the iron bar of the bed frame, and was thus strangled.

Suicide by smothering is also rare, but a case occurred in France in which a woman placed herself under the bed-clothes after desiring her little child to bring all the cushions, clothes, and other similar articles that were in the room and to pile them on top of her. The child did so, and some hours afterwards the woman was found dead. A woman in an asylum, aged thirty-eight years, was found early one morning, dead in bed with part of a stocking protruding from her mouth, death having resulted from suffocation. No noise or disturbance was noticed by other patients who slept in the same ward. At the inquest a long stocking was exhibited, which, with great difficulty, had been removed from the air-passages.

Many cases similar to the above are recorded, all of which are of great medico-legal value as demonstrating what suicides may do in the way of inflicting injuries upon themselves. On superficial examination, homicide may be suspected, whereas other evidence may conclusively prove the case to be one of suicide. Doubtful cases of this kind need the greatest care on the part of the examining practitioner.

SUICIDE AS A FELONY

The law of England regards suicide as a felony: those who have attempted unsuccessfully to commit suicide are held to be sane and responsible agents, unless from other circumstances there is clear evidence of their insanity; and it is certain that the evidence required to establish this must be much stronger than that which is sometimes admitted in cases of homicide. By the Interments (Felo-de-se) Act, 1882, the laws and usages relating to the interment of the remains of persons against whom a finding of *Felo-de-se* has been returned were altered and amended. Instead of directing the remains of such a person to be buried in a highway, with a stake driven through the body, the coroner is to direct the remains to be interred in a churchyard or other burial ground, subject to the provisions of the Burial Laws Amendment Act, 1880. It was hoped that this enactment would lead to the discontinuance of the habit of returning verdicts of " Temporary insanity "; but it has failed to do so.

In the first volume of the Transactions of the Medico-legal Society (London) is an article by R. Henslowe Wellington on this subject, to which the reader is referred for many interesting details on the history of *Suicide*, including that of the word itself. Wellington there traces the changes in the law which have taken place in the last century, especially with reference to the different results which ensued upon a verdict of *Felo-de-se* or upon one of " Suicide whilst temporarily insane." He points out that since 1870 there has ceased to be any difference except in the absence of ritual at the burial, and that since 1880 or 1882, even this difference is by permission abolished. Notwithstanding this gradual approach to rational procedure, the public mind is still influenced by old ideas; and a verdict of *Felo-de-se* is considered to be a disgrace, whereas one of " Suicide whilst temporarily insane " is regarded with less repulsion.

Responsibility of One who assists or advises Another to Commit Suicide

If two persons agree to commit suicide and only one dies, the survivor is guilty of murder. If one encourages another to kill himself, and he does so, the adviser is guilty of murder. The accused may, of course, be acquitted on the evidence; but the verdict must be murder or acquittal; he cannot be convicted of manslaughter.

Responsibility of One who attempts Suicide

All judges do not take the same view of attempted suicide; each case must be dealt with in the light of the circumstances in which the attempt was made. Many miserable creatures accused of attempted suicide have been discharged either with a caution or on the recognisances of themselves or their friends; others are ordered to be detained in mental hospitals as persons of unsound mind; comparatively few are severely punished. Of the latter the following are examples :—

A man was condemned to a term of imprisonment in the following circumstances: —He and his wife had fallen into pecuniary distress through his drunken and idle habits. This led to much quarrelling, and finally he bought some poison, of which he took a part, and part of which he (more or less) compelled his wife to take; she died, but he recovered.

In *R.* v. *Eddington*, a woman was tried for murder. The evidence, partly confirmed by the statement of the prisoner, showed that she had felt some resentment against the relatives of the deceased for having, as she believed, slighted her and tried to cause an estrangement between her and her *fiancé*, and that this resentment had later been extended to him. A tramcar conductor heard the sound of shots. Upon going into the shop, the scene of the tragedy, he found the deceased in a crouching position, insensible, and bleeding from wounds in the head. In one hand was a string which held some brushes together. The prisoner was lying at full length on the floor with her head towards the door. Between the two stood some steps. At the far end of the counter beyond the man, was some blood which had apparently fallen on the floor. Some five feet or so distant, and close to the right of the deceased, was a quantity of blood that had run down from his head. The deceased had two bullet wounds, one of which entered obliquely downwards from left to right through the upper lip, the other one and a half inches behind the left ear. The shot which had caused the latter had gone through the lateral sinus and lodged against the opposite side of the skull. The prisoner had a graze and some small blisters on the right side of her forehead. The deceased did not regain consciousness before he died six and a half hours after the shooting. The prisoner said that she had written a letter to deceased telling him of her intention to shoot herself in his presence. This letter was not discovered, but an envelope in her handwriting and bearing the date she named was found in a locked box belonging to the deceased. A letter which had been written by her at her home, she had torn up and thrown into the fireplace. In it were the words "he shall lose everything." The prosecution relied on this as proving malice, but for the defence it was contended that the letter was torn up because it did not truly represent the feelings and ideas of the prisoner.

The facts and suggestions put before the jury in seeking for a conviction on the capital charge were: (1) a motive of revenge for neglect and unrequited love; (2) the statement in the letter before referred to; (3) that the steps stood between the two persons; (4) that the clothes of the prisoner were not disarranged and that there was no blood upon them; (5) that the objects of merchandise in close proximity had not been disturbed; (6) that the deceased was holding in his fingers the string which tied the brushes together; and (7) that the two patches of blood were some distance apart, with no intervening marks. For the defence it was contended that the deceased was accidentally shot while endeavouring to wrest the revolver from the prisoner; and the prisoner said that the deceased seized the weapon in his left hand and that it went off during the struggle. The jury adopted this view, and acquitted the prisoner, who pleaded guilty to the further indictment of having fired with intent to kill herself. The judge sentenced her to fifteen months hard labour, and remarked that by her wicked and foolish act she had sacrificed the life of the deceased, who had by a praiseworthy act tried to save her life.

For a case of suicide as murder by taking "lysol" in accordance with a suicide pact made by a couple who had been "keeping company," see *Lancet*, 1926, 1, 1218.

If a person intending to shoot himself fails to do so, and by accident shoots a bystander, he will be held responsible, unless there be a clear proof of insanity.

In *R.* v. *Fisher*, the prisoner was tried for the murder of his wife by poison. The man was well conducted and industrious, but he fell into a despondent state of mind, and was sure that by the introduction of machinery into his trade of a shoemaker, he and his wife would be reduced to poverty. He communicated this feeling to his wife; they pondered over it together, and they both agreed to commit suicide. The man procured a quantity of laudanum, and shared it with his wife, each taking about an ounce. The wife died, but owing to early vomiting, the prisoner recovered. Before marriage, the prisoner had been a patient in a mental hospital; nevertheless, he had completely recovered, and immediately prior to this occurrence, both husband and wife were low and dispirited: but there was at that time no clear indication that the prisoner was suffering from insanity.

SUICIDE IN THE INSANE

Formerly, "suicidal mania" was a term descriptive of a particular species of insanity; but the term has long since been discarded, as it is now recognised that almost any person of unsound mind may kill himself if time, opportunity, and the means coincide. The suggestion may proceed either from sudden impulse or from long deliberation; it may be committed with or without apparent motive; it may proceed from a delusive apprehension of poverty, disgrace or ruin. Suicide from sudden impulse is not uncommon amongst the insane, and every person who suffers from melancholia may be considered a potential suicide.

A person is often impelled to suicide by the overpowering and crushing influence of a *latent*[1] delusion which may for weeks, and perhaps months, have been pressing like an incubus on his imagination. Patients sometimes confess that they have been under the influence of monomaniacal ideas and terrible hallucinations for a long period without their existence being suspected, even by their most intimate associates. "For six months," wrote one patient, "I have never had the idea of suicide, night or day, out of my mind. Wherever I go an unseen demon pursues me, impelling me to self-destruction. My wife, friends, and children observe my listnessness and perceive my despondency, but they know nothing of the worm that is gnawing within."

Persons thus mentally affected generally retain a certain control over their actions; thus they will voluntarily give up pistols, razors, or other weapons by which suicide might be committed.

A friend suffering from an attack of suicidal mania, while residing with Taylor in Paris, one night delivered to him his razors, with a request that he would lock them up and keep them out of his sight, as otherwise he feared that he might kill himself at any moment. Although he recovered from this attack, he had a relapse, and subsequently killed himself by taking prussic acid.

A person suffering from this form of insanity may go to bed perfectly collected, and suddenly awake in the night and kill himself by hanging, drowning, or precipitating himself from a window. These cases probably depend on the persistence of some horrible mental impression which may have occurred in dreaming, and in the reality of which they cannot at the time disbelieve. A case of this kind occurred in Guy's Hospital.

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[1] Latent here means that the victim had not mentioned his delusion audibly or by writing to any one.

The man attempted, in the dusk of the evening, to strangle himself with the cord of his bed; he was fortunately saved, and he recovered after having been nearly strangled. He said that he suddenly saw a large black figure (the devil), near his bed, which by signs and words compelled him to try to hang himself. This man had previously shown symptoms of suicidal mania.

Such impulses have been known to disappear under some violent shock; for instance, a case is related of a man who, while hurrying to one of the bridges of Paris to throw himself into the river, was suddenly attacked by robbers; he made a desperate resistance, and escaped. He could not then account for his being where he was, and quietly walked home, having abandoned the intention of suicide.

Suicide is no proof of unsoundness of mind, and, as a matter of fact, suicide is not particularly common amongst patients in mental hospitals; although supervision of patients of suicidal tendencies is much more vigilant than formerly.

A form of unsoundness of mind in which suicidal tendencies are strong appears not infrequently to be hereditary.

In one case, this propensity manifested itself through three generations. In the first, the grandfather hanged himself. He left four sons—one hanged himself, another cut his throat, and a third drowned himself in an extraordinary manner, after having been some months insane; the fourth died a natural death, which, from his eccentricity and irregularity of mind, was hardly to be expected. Two of these sons had large families; one child of the third son died insane, two others drowned themselves, and another became insane and made determined attempts on his life. Several members of the fourth generation, when they arrived at the age of puberty, showed a tendency to the same fatal propensity.

Suicidal impulses amongst the insane are susceptible of being extended by imitation, especially when the mode of self-destruction adopted is accompanied by circumstances of a horrible kind, or by such as to excite great notoriety. The sight of a particular spot where an act of suicide has been committed will sometimes induce a person, who may hitherto have been unsuspected of any such disposition, at once to kill himself. Thus, soon after a suicide had taken place at the Monument, near London Bridge, two further cases occurred. Similar events are recorded in connection with the numerous suicides committed from old Waterloo Bridge.

The following example occurred at the Lincs. County Mental Hospital:

In one of the male wards a patient had been talking of a woman in London who had swallowed a fork, and had lived five years afterwards, and a patient evidently became seized with the idea of emulating the feat, for when next he secured a fork he placed it, haft foremost, in his mouth. Noticing the act, a nurse rushed across the room, but before he could reach him, the patient had thrown his head back and pushed the fork, nine inches long, completely down his throat.

HOW FAR DOES SUICIDE INDICATE INSANITY?

Suicide is often regarded as furnishing conclusive evidence of insanity, a doctrine which often finds expression in the verdicts of coroners' juries—

not so much from the fact that insanity is thereby established as that any verdict other than this might stigmatise the family of the deceased (*vide infra*).

This is not the place to discuss the question from a moral or ethical point of view. We can look at it only from the practical aspect. Suicide is viewed by the authorities as a crime against the State.

Juries do not, however, always accept the medical view as to "temporary insanity."

An inquest was held on the body of a man who had recently undergone an operation, and who had since been strange in his manner. On the day before his death, he was on the top floor of the building, standing by a crane door, one section of which was open. He stared at the foreman without speaking, and then deliberately jumped over the bar of the crane doorway into the street. He was taken to St. Bartholomew's Hospital, where he confessed that he had previously taken oxalic acid. Death occurred the following day, as the result of his injuries.

A verdict of suicide was recorded.

In the following cases the jury returned a verdict of *felo-de-se* :—

Whitaker Wright, a fraudulent promoter of companies, on being sentenced to penal servitude, committed suicide by taking cyanide of potassium before leaving the court.

Robert Bullen, sentenced to ten years penal servitude for manslaughter, committed suicide in a cell in Bodmin Prison. Deceased was found hanging from the cell ventilator by a piece of string which he had managed to hide in the mattress of his bed after the previous day's work. He had placed the table of the cell near the door ; and, having fixed the string to the ventilator and around his neck, must have quietly dropped off the table. When found, he was dead. The jury returned a verdict of *felo-de-se*, and attached no blame to any of the officials, every precaution having been taken.

Early in 1904, Crossman murdered his seventh wife ; cemented her in a box, and afterwards killed himself.

Critics of the above findings must bear in mind that "the state of a man's mind is as much a fact as the state of his digestion," and facts are for the jury alone.

From cases cited below, it is clear that the act of suicide is not treated by the law as a *proof of insanity*.

Acts of suicide are sometimes mistaken for homicide, merely because the deceased had neither expressed an intention of killing himself, nor had evinced by his conduct any previous disposition to commit suicide. In this connection, however, it must be remembered that suicide from sudden impulse is not rare, and that if a person were to announce his intention of committing suicide, preventive measures would probably be taken.

SUICIDE AND LIFE INSURANCE

This presents the following problems :—

1. A consideration of the sanity of the assured at the time when he commits suicide.
2. Whether a violent death was due to accident, suicide, or homicide.
3. Bogus suicides, or even bogus deaths.

Problem 1. Sane or Insane at the time of Suicide ? According to the rules of some insurance offices, a policy of life insurance is forfeited by the act of suicide.

The question is: Does the proviso in the policy as to suicide include all acts of suicide, or is it restricted to cases where the deceased was sane when he took his own life?

The question whether drunkenness excuses suicide was raised in the case of *Borradaile* v. *Hunter*.[1]

In *Ellinger* v. *Mutual Life of New York*,[2] an application for a life policy for the benefit of creditors stated that it was the basis of the contract; and the applicant warranted that he would not commit suicide, *whether sane or insane*, during the period of one year from the date of the contract; and the policy stated that the application was made part of the contract. The applicant committed suicide within the year, while insane. It was held that the warranty against suicide was a condition of liability; and that, therefore, the company was not liable.[3]

Modern policies usually provide that in cases of suicide during insanity, the policy shall not be paid in full, but shall be surrendered and the surrender value thereof paid to the personal representatives or beneficiaries named thereon. By this means substantial justice is done (and all possible motive for suicide as a means of provision for one's family removed), since the assurer avoids having his risk increased by the acceleration of death in such a manner by treating such an event as resignation of the utmost benefit derivable from the policy; and the beneficiaries enjoy the benefit of the policy so far as it was earned by payment of premiums.[4]

Problem 2. Was the Violent Death Accidental, Suicidal, or Homicidal? A person may die from poison, wounds, drowning, or other forms of asphyxia or of violent death; and it may be difficult to determine whether the death was caused by accident, suicide, or by violence inflicted by another. The coroner's jury's verdict, "Accidental death," merely indicates the absence of a criminal cause of death. If the life of the deceased should happen to be assured under a policy containing this condition respecting suicide, the question may become of great importance to the assurers, and they will require clear evidence that the death was natural or accidental, and not suicidal, before paying the amount of the policy. The cause of death should in all cases of violence be determined by a medical man; this would put an end to any dispute concerning the payment of the policy, and relieve the representatives from the trouble and expense of litigation. If the death be sudden, and any suspicious circumstances are left unexplained, it is almost certain that a civil action at law will follow.

It is often a matter of great difficulty to distinguish suicide from accident; but the distinction is absolutely necessary when a claim is made for the payment of the amount due under a policy of assurance.

So far as medical evidence can throw light on the problem, it has already been very fully discussed under the various forms of violent death (*q.v.*) and need not be discussed further.

Problem 3. Bogus Suicides and Deaths. This form of fraud is by no means yet obsolete; but the proof of fraud in such cases rarely depends upon medical evidence.

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[1] 12 L. J. C. P. 225.

[2] [1905] 1 K. B. 31.

[3] See also *In re United London and Scottish Insurance Co., Ltd.*, [1915] 2 Ch. 167.

[4] *Vide* "Porter on Laws of Insurance" (8th ed.), p. 129

CHAPTER XVII

LIFE ASSURANCE—GENERAL AND ACCIDENT

GENERAL LIFE INSURANCE

The assurance of a life is a contract whereby the assurer, in consideration of a certain sum of money, called a *premium*, either in a gross sum or in periodical payments—proportioned to the age, sex, profession, health, and other circumstances of the person whose life is assured—undertakes to pay to the person for whose benefit the assurance is made a stipulated sum or an equivalent annuity, upon the death, or arrival at a certain age, of the person whose life is assured.

Policies of almost every conceivable variety are now issued, each office vieing with every other one to attract business by the variety and advantageous proposals of its policies; and certain offices offer policies without medical examination at all.

The document setting out the terms of the contract is called a *policy*. Litigation sometimes arises concerning the stipulations of the policy, and the meaning to be put upon certain medical terms used in it.

The sum for which a person's life has been assured, if payable on the death of the assured, is not recoverable until proof of death has been furnished.

The Policy is a Contract

Inasmuch as in all contracts the law requires each party to comply strictly with the conditions thereof, it follows that, if any fraud has been committed by the assured, or by his medical adviser, *e.g.*, by the concealment of the existence of any disease from which he was suffering at the time, or any symptoms indicative of a probable attack of disease—or if there is any wilful misrepresentation or false description of his actual bodily condition, the contract will be void, and the premiums will be forfeited. This forfeiture is a usual condition in the policy. Actions on policies of life assurance are not infrequent, although disputes are usually referred to arbitration.

In nine cases out of ten these actions depend upon the construction put on the medical terms of the contract; hence consideration must be given to the manner in which medical disputes are likely to arise in regard to the policy. The conditions of assurance vary with different offices, and with the particular kind of policy which is taken up by the assured. The questions to which replies are required may be divided roughly into general and special.

General Replies

In regard to what may be described as the general questions, although there is nothing therein which is of any particular medical interest, persons intending to assure should be scrupulously accurate in their replies. It is preferable to make the mistake of giving unnecessary particulars rather than to omit any necessary facts, however trivial they may seem.

It is to be hoped, for the honour of the medical profession, that cases will remain rare in which medical examiners are charged with obtaining money by false pretences by signing assurance papers stating that they have examined the proposer, whereas, in fact, they have not done so, at least within the terms of the signed paper. Such a case is reported in the *Lancet,* 1901, 1, p: 1271.

Special Replies

It is now a general practice for all life offices to have one or more medical officers of their own, to whom candidates may present themselves. Alternatively, a medical report from an independent medical practitioner is submitted for inspection to a medical officer of the office, and the latter may either pass the applicant at once or may cause further inquiry and report to be made, either by the medical practitioner who signed the report or by other persons. Sometimes a personal interview may be required.

If a medical practitioner signs such a certificate, it is his duty to exercise the greatest caution, not merely replying to the questions on the paper, but giving *all particulars known to him respecting the state of health of the applicant.* There is no intermediate course: the duty must either be performed carefully, conscientiously, and honourably, or it must be declined altogether. Any equivocation or concealment in the certificate is unlikely to escape detection.

The questions required to be answered, either by the candidate or by his physician, vary according to the office concerned.

Assurance offices are not to be blamed for making these searching inquiries and for acting with vigour. Frauds of the worst description have frequently been attempted; and it is only by the adoption of such searching inquiries that the offices can protect themselves.

Litigation sometimes turns upon upon the meaning of the expression "*Any other disease or disorder tending to shorten life,*" and the opinions of medical experts are usually required.

It is impossible to lay down any general rules for determining what diseases have and what diseases have not a tendency to shorten life. Any deviation from health might be so interpreted; but the law regards the expression as applying only to those diseases which in the medical view, are regarded as of a serious nature, and, as a general rule, are likely either directly or indirectly to affect the duration of life of any person suffering from them. This expression referred to does not imply that the assured must have been at the time entirely free from all the seeds of disorder or latent disease in order to render a policy valid; such a condition is impossible. A man may be suffering from an insidious disease—ulceration of the stomach or intestines, for instance—leading to perforation; but if this be, as it often is, unknown both to himself and to his medical adviser, the assurers are bound to take the risk. In other words, a life may be a good life, although the person at the time may be suffering from a latent bodily infirmity.

In one case a young man died from caries of the spine, with psoas abscess, etc., within a year of his assurance. The abscess was present at the date of assurance; but, as the candidate was unaware of it and the medical officer did not detect it, the assurance money was paid promptly.

On the other hand, a disease which tends to shorten life must not be taken to signify only one of those maladies which usually have a rapid and fatal course—as phthisis and cancer: it may apply to gout, asthma, insanity, and many diseases of a chronic nature. When the existence of these diseases, or even a well-marked *tendency* to them, is concealed from the assurers, or omitted to be stated through mistake, even without fraudulent intention, the policy becomes void in the event of death. Such diseases are not necessarily fatal; but that is not the question: the *tendency* thereof is to diminish the expectation of life; and if this is established by medical evidence in regard to any disorder concealed intentionally, whether chronic or acute, the policy will be void, and no action will lie for the return of premiums.

Material Concealment. Some medical practitioners think that, provided they can certify that the person is in good health at or about the date of the assurance, this is all that the assurers need know (as a matter of medical experience it has been established that no certificate for life assurance is worth more than three years' validity). The applicant frequently shares this view; and after having been attended by one medical man for an illness, will apply to another practitioner, who may be a comparative stranger, to certify as to his condition of health for assurance. We must not lend ourselves to this practice, which is based sometimes upon mistake, and sometimes upon fraud. If medical men would decline to sign the papers in such circumstances, they would not only avoid censure, but would confer a benefit upon the applicant, by preventing him from obtaining a policy upon terms which may render it invalid. From what has already been said, it will be understood that the exact state of health of the person at the date of the assurance does not represent the whole of the risks incurred by the office. The restoration to health, as in a case of diseased lungs, may be only temporary: it may speedily be followed by phthisis; and the assurers therefore ought to be informed of the previous condition as well as of the present condition of the applicant. The disease from which the assured had suffered may have been of a trivial kind, and not likely to affect the risk; nevertheless, the safest plan is to state it. The choice will then lie with those who are to incur the risk.

No certificate should be signed by a private medical adviser without the definite consent of the applicant for assurance.

Some medical men have adopted the plan of signing certificates, but have declined to make any written reply to certain questions, *e.g.*, the general question: "Can you give any and what information respecting the **habits of the applicant ?** " If nothing be known concerning these, it should be so stated; if, however, the existence of any habits affecting health be known, the information should not be withheld.

At the time of effecting the assurance a person may not be suffering from any disease, but his habits may be such as to produce general injury to health, or to have a tendency to shorten life. Concealment of habits, the effect of which on health must or ought to be known to all medical men, must be just as fatal to a policy as the concealment of a serious disease. Although such habits may not always be the subject of questions asked by the office, yet the law requires that the assurers should be made acquainted with all circumstances which might reasonably affect the risk. Concealed habits of drunkenness have thus given rise to medical questions of considerable importance; and in one case, a question arose whether the practice of opium-eating (which had been concealed from the assurers), had or had not a tendency to shorten life. The existence of such habits must be known to the person himself; and the declaration which he signs is so explicit that, if intentionally concealed by him, he has only himself to blame if the policy is voided and the premiums forfeited.

In a large number of cases the payment of policies is resisted on the ground of concealed **drunkenness and general habits of intemperance.** There is some difficulty in these cases, because medical men may entertain different opinions respecting the effect of such habits upon the general health, and the degree to which they may be safely practised. Whatever may be one's opinion of the effect of such habits on health, one must state, if they are known, that they exist, so as to put it out of the power of the assurer to dispute a policy upon such a ground. In consequence of the frequent concealment of habits of this kind, most offices now adopt the practice of making it a special question, to which a plain negative or affirmative answer should always be given: "Are you now and have you always been of temperate habits?"

The real question, however, is whether any person can indulge in an excessive use of alcoholic liquor without sooner or later suffering from an impairment of health. Although the effects of such habits may not be manifested immediately, the office is entitled to be informed of the existence or non-existence thereof, and not of the time at which they are likely to affect health or to produce a fatal disease. To assert that a man may be addicted to excessive drinking without impairing his health is to make a statement which is contrary to experience. Habit may accustom a man to intemperance—it may enable him to drink a large quantity of alcoholic liquor without being apparently influenced injuriously by it at the time; but if persisted in, pathological effects on the digestive system, the central nervous system, the muscular system, the kidneys, etc., will probably supervene. A strong constitution may enable a man to resist the effects for a time; but, ultimately, they will reveal themselves in some form of disorder.

The concealment of the habit of **opium-eating** gave rise to an important trial.

The Earl of Mar effected an insurance on his life, and two years afterwards, at the age of fifty-seven, he died of jaundice and dropsy. The assurance company declined to pay the amount of the policy, on the ground that the Earl was, at the time of the assurance, and had been for some time previously, an opium-eater. This habit had been concealed from the assurers; and it was further alleged that it had a tendency to shorten life.

In most of the instances mentioned at the trial, there was no evidence that life had been shortened by the practice. On the contrary, there was evidence that some people had practised the habit for years, and had lived to an old age. It appeared that the assurers had not made the usual and careful inquiries into the habits of the deceased; the assurers were deemed therefore to have taken the risk upon themselves. It appeared that the general question in regard to habits was not answered by the medical referee, and it was considered therefore that the office had waived the knowledge of them. A new trial was ordered, on the ground of misdirection, but the action was compromised.

On the whole, it appears that the habit of opium-eating is, as a rule, injurious to health, and is calculated therefore to shorten life. In any proposal for life assurance, the assurers should be informed of this habit where it exists, and no medical man should be a party to its concealment, merely because many persons addicted to it have lived for years in what appears to be tolerable health. One of the questions put to a medical man is, whether he knows of any material circumstances touching the health or habits of the person to which the other inquiries in the certificate do not extend; and if so, he is required to state them. Without going so far as to state that the life of an opium-eater is uninsurable upon a common risk, the habit is itself sufficiently material to require that it should be declared in reply to such a question as this. The practice may be, and often is, concealed from a medical adviser; in that case the assured, if not candid in avowing its existence, must expose his representatives to the risk of losing all benefit under a policy. The questions asked by assurance offices today are so explicit that they must be considered as including the habit of opium-eating; and there does not appear to be any ground for evading the admission of the practice, either on the part of the candidate, or (if known to him) of his medical adviser.

A commercial traveller aged forty-nine, effected a policy on his life for £1,000. He died in the year following the assurance. Payment was refused on the ground that the answers of the deceased were untrue, and that there had been suppression of a material fact. He was asked whether he had ever been *afflicted with gout*, and he answered" No." He was asked whether the life had been offered at any other office, and, if so, whether it was accepted; and he answered that it had been proposed, and accepted at an ordinary rate. These were the answers which it was alleged were false. A surgeon stated that two years before the assurance, the deceased was suffering from suppressed gout. He had an " extremely slight attack," which lasted only about forty-eight hours; he did not tell the deceased that it was gout; he believed that he died of suppressed gout in an aggravated form. A proposal of the deceased to another company, which had been declined, was put in evidence. On the part of the claimants it was contended that there was no evidence that the deceased had ever been " afflicted with gout."

The Court held that the assured had not been afflicted with gout at the time of the proposal; also that the answer to the other question was untrue, but not to his knowledge. The judge directed a verdict for the claimants, subject to a point reserved for the court whether the knowledge of the untruth was material.[1]

Diseases affecting the **urinary organs** have generally a tendency to shorten life. This is especially the case when these diseases are chronic, and occur in persons advanced in life.

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[1] *Fowkes* v. *Manchester and London Assurance Co.* 32 L.J.Q.B. 153.

In the *Lancet*, 1902, 2, p. 867, will be found a critical analysis by Parkes Weber, of 500 insured deaths in reference to antecedent **syphilis.**

INSURABLE INTEREST

Every person who takes out a policy of life assurance must have an insurable interest (which must be a pecuniary interest), in the life assured. Every person is presumed to have a pecuniary interest in his own life. A wife may insure the life of her husband upon whose income or exertions she is dependent, and a husband may insure the life of his wife, but the assurance of the lives of others has been considered objectionable, on the ground that it tends to create an interest in the death of a person, and thus to lead to secret acts of murder.

The general rule as to relatives is that where the person who effects an assurance on the life of another is so related to that other as to have a legal claim upon him for support, such relationship creates an insurable interest. A son has an insurable interest in the life of a father who supports him, but not in the life of a father whom he supports.

From the evidence given at the trial of Mary Ann Cotton,[1] there is reason to believe that in some cases a life assurance has been effected secretly for the purpose of murder.

The prisoner was indicted for the murder of her stepson by poisoning. The body of the deceased was exhumed, and arsenic was detected in it. This was the sole cause of death. The prisoner over a period of a few years had killed by poisoning her mother, fifteen children, three husbands, and a lodger—making altogether twenty persons. Most of them had been insured ; and in some of these cases the prisoner had claimed and received the money payable. One of her three husbands thus disposed of, and four of her children, were assured in the same office. They died in quick succession, and the medical man assigned *gastric fever* as the cause of death, although the symptoms were not consistent with that disease. The prisoner obtained from the office a sum of thirty-five pounds upon the death of one husband, and some smaller amounts from burial clubs by the death of the children. She then married a man with a family of children, and she appeared very anxious to have his life and the lives of his children assured. One day the man discovered her at an office trying to obtain an assurance on his life He then refused to live with her, and thereby possibly saved his life. She was convicted of murder.

The **assurance of the lives of children** is still prevalent, but by the Children and Young Persons Act, 1933, sec. 1, severe punishment may be awarded to a person who, having the charge of a child or young person has been convicted of the manslaughter of such child or young person and is proved to be interested in the death of such a child or young person, under a policy of insurance.

ACCIDENT INSURANCE

THE WORKMEN'S COMPENSATION ACTS

In litigation arising out of insurance against accident, whether under private policies or under the Workmen's Compensation Act, 1925, and its amending statutes, medical evidence is usually called for. Most accident policies contain clauses providing for weekly payments during total and partial disablement (the Workmen's Compensation Acts provide, without a policy, for similar disablement), and in these cases as well as in ordinary private cases (under Lord Campbell's and other Acts) the amount of damage must be proved ; and medical evidence is the principal means by which disablement and personal damage can be estimated. It is necessary, therefore, to consider the matter from a medico-legal point of view.

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[1] *R.* v. *Cotton,* 12 Cox C. C. 400.

As a general rule, for the purposes of the Workmen's Compensation Acts, a " workman " means any person who has entered into or works under a contract of service with an employer. Persons employed otherwise than by way of manual labour whose remuneration exceeds £420 a year are excepted (among others) from the statutory definition of " workman."

A servant has been defined by the Court of Appeal as " a person subject to the command of his master as to the manner in which he shall do his work ; and the greater the amount of direct control exercised over the person rendering the services by the person contracting for them, the stronger are the grounds for holding it to be a contract of service ; and, similarly, the greater the degree of independence of such control, the greater the probability that the services rendered are of the nature of professional services, and that the contract is not one of service." [1]

It would appear, therefore, that, for the purposes of the Workmen's Compensation Act, nurses are " workmen " under contracts of service with hospital authorities while engaged upon their duties in or about the hospital. It has been held in Scotland that a contract of service does not exist where a trained nurse was employed to look after the sick child of a former servant.

The Workmen's Compensation Acts provide for payment of compensation to a workman who is rendered totally or partially incapable of work by injury resulting from accident, and the right to claim compensation is based on the proved inability to earn wages as a result of such accident. There is no provision for pain occasioned by the accident. The accident to be the subject of compensation must have arisen out of *and* in the course of employment.

The said Acts also provide for the payment of compensation in cases where a worker dies or is disabled through having contracted an industrial disease.

NATIONAL INSURANCE (INDUSTRIAL INJURIES) ACT, 1946

This comprehensive Act is designed to take the place as from the appointed day (which at the time of going to press had not been fixed) of the Workmen's Compensation Acts ; so that " workmen's compensation " will not be payable in any case where a right to compensation arises in respect of employment after the appointed day. The new Act provides that all persons employed in insurable employment shall be insured against personal injury caused by accident arising out of and in the course of a person's employment, and against specified diseases and injuries due to the nature of such employment.

The term " workman " disappears ; and when the new Act comes into operation, there will no longer be an exception as regards " persons employed otherwise than by way of manual labour whose remuneration exceeds £420 per annum."

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[1] [1910] 1 K. B. 543, at p. 550.

WHAT IS AN ACCIDENT?

The term "accident" has not a definite legal meaning, and it may refer either to the personal injury which has resulted or to the mechanical cause of the injury. It may be defined as an unexpected or unforeseen event happening at a particular time which has caused a personal injury. The distinction between the unforeseen event and the result of that unforeseen event is not always clearly drawn.

In *Fenton* v. *Thorley*[1] it was held by the House of Lords that the word "accident," as used in the Act, was used "in the popular and ordinary sense of the word" as denoting an unlooked-for mishap or an untoward event which is not expected or designed, or as denoting or including any unexpected personal injury resulting to the workman in the course of his employment from any unlooked-for mishap or occurrence; or any unintended and unexpected occurrence which produces hurt or loss.

In the House of Lords in *Clover, Clayton & Co.* v. *Hughes*,[2] it was held that the event constituting the accident must be unexpected in the sense that an intelligent man would not have expected it from the nature of the work and that it was not correct to ask whether a medical man who knew the condition of the workman would have expected it.

As a result of numerous judicial decisions, the term "accident" has been amplified and extended far beyond its original meaning, and includes many conditions which have arisen from natural disease, but in which the occupation has contributed in a minor degree to the fatal result. In the above case, for example, Hughes suffered for years from an aneurysm of the aorta; and rupture occurred whilst he was screwing a nut with a spanner. Although little or no exertion was required, it was held that death was caused by an accident arising out of the employment.

Is Sunstroke an Accident? It has been held that the accidental injury arose out of the employment where a man in the tropics sustained sunstroke while painting the side of a ship, he being subject to a greater risk of sunstroke in this position owing to the reflection of heat from the side of the vessel.[3] Another similar case was where in the tropics a man sustained sunstroke through being required as part of his duties to stand on the steel deck of a ship without shelter for five hours, and to bend over the hatchway.[4]

The principles involved in cases of this sort were considered by the House of Lords in *Upton* v. *Great Central Railway*,[5] where it was laid down that in considering the special danger with which the workman is brought in contact by the conditions of his employment, it is not necessary that there should be direct active or physical connection between the act causing the accident and the employment; but it will suffice if the accident arises directly out of circumstances which he has had to encounter because to encounter them fell within the scope of his employment; subject, of course, to any defence of serious and wilful misconduct, if and when that defence is available.

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[1] [1903] A. C. 443.

[2] [1910] A. C. 242.

[3] *Morgan* v. *Owners of S.S. "Zenaida"* (1909), 25 T. L. R. 446.

[4] *Davies v Gillespie* (1911), 105 L. T. 494.

[5] [1924] A. C. 302.

Is Lightning an Accident ? Where a person is killed by lightning, the question sometimes arises whether the death was accidental or not. Death by lightning is obviously not a natural cause of death ; and any person killed by lightning may be said to have died accidentally.

THE RELATION OF ANTECEDENT DISEASE TO "ACCIDENT."

This question is intimately connected with medical evidence. It arises where a workman is suffering from a disease, and something happens in the form of an acute manifestation of the disease. He alleges that it is accidental or attributable to his occupation, and he makes a claim in consequence. Medical evidence alone can determine the relation of the work to the incident.

A workman may be suffering from a disease which does not incapacitate him in any degree but as a result of the accident he may suffer disability owing to the fact that the result of the accident in such a person causes greater and more prolonged disability than a similar injury would have produced in another person. It has been laid down that if a man who is afflicted with an infirmity is injured and is thereby incapacitated from carrying on the work which he was previously able to do, that is an injury resulting from the accident even though the accident would not have incapacitated him had he been otherwise sound.

The reader is referred to the standard works on the subject for particulars of typical cases in which questions of compensation have arisen under this heading.

All diseases are not rapidly fatal ; some of them are cured, leaving the working capacity of the patient as good as it was before the attack. Other diseases, although ultimately they may cause death directly or indirectly, by no means deprive a man of capacity for all work during the earlier and subsequent stages of the disease.

In the interests of all concerned, it is imperative that in **all fatal cases an autopsy should be held** in order that medical facts may be ascertained.

To deal exhaustively with the facts which may be ascertained by autopsy, would be tantamount to writing a work on morbid anatomy combined with clinical medicine. There are many medical men who are not prepared to give an opinion on pathological phenomena, but there should be no difficulty in obtaining the services of skilled observers. The autopsy should be made by a skilled pathologist.

In non-fatal cases it is sometimes as easy as in fatal cases to detect the presence of antecedent disease ; sometimes, on the other hand, it is much more difficult, and occasionally only clinical inferences and experience enable one to determine whether disease was present previously to the alleged accident.

Wounds in persons suffering from diabetes or chronic kidney trouble, take a comparatively long time to heal. A slight injury sustained by such persons is liable to result in a general breakdown. Antecedent *syphilis*, however well treated, lies at the root of very numerous troubles—*aneurysm*, *arterio-sclerosis*, *chronic myocarditis and bundle degeneration*, *degenerations of nerve structures*, *progressive loss of sight*, etc., etc.—and a known history of syphilis should make one very cautious in giving certificates. *Chronic valvular disease of the heart* is a very common condition arising from rheumatism ; it does not always cripple the patient. It is easily discoverable by the stethoscope, and is very different from *fatty degeneration of the heart* and other myocardial lesions, which are not easily discoverable. Lesions of the valves are much more favourable to life than lesions of the muscular tissue of the heart. Accident often causes injury to the heart or its valves. *Chronic gastric ulcer* can easily be mistaken for simple indigestion and so, too, can cancer of the stomach in its early stages. *Cirrhotic liver* from alcoholism does not cause any immediate diminution in working capacity, yet its discovery after an accident is of very great significance. An *abscess in the brain* may be latent for a long time, and *chronic middle ear disease* (the most frequent cause of such abscesses), does not necessarily cause incapacity. A man suffering from *phthisis* or consumption of the lungs is characteristically hopeful and full of energy, while tuberculosis of bones or joints may be present and remain latent for long periods whilst a workman appears to be fully healthy.

RELATION OF ACCIDENT TO SUBSEQUENT DISEASE

There are many cases in which it is not difficult to form an opinion, inasmuch as the workman's disability is the obvious and direct result of the injury caused by accident, *e.g.*, cuts, fractures of bone, sprains of joints, crushes, bruises, etc.

But there are cases in which the relationship is by no means so obvious or certain, and in which an opinion should be arrived at only after very full consideration of all the possible factors. These are cases in which the accident or the nature of employment has determined the onset or exacerbation of a disease which may either remain until death or become progressively worse till it results in death or permanent illness. It is hardly possible to give a comprehensive list of all the conditions which may bear such a relationship to accident (or work), but it would certainly include the various forms of *fibrositis*, *osteo-arthritis*, *rheumatoid arthritis*, and other so-called rheumatic conditions ; a variety of diseases of the brain and nervous system and of the heart and circulatory system ; inflammation and ulcerative conditions of the alimentary tract and diseases of the respiratory system, including the various dust diseases and tuberculosis ; disease of the hollow viscera following bruising or laceration ; damage to the kidneys, ureter or bladder, and infectious lesions of these organs secondary to spinal cord injury ; lesions of the testis and epididymus ; disease of the organs of sight, smell and hearing, and diseases of the skin ; in fractures of various kinds, and in malignant disease.

In almost all cases in the first group, and in some individual cases in the second, the degree and duration of disablement is the main point to be settled by medical evidence ; in most cases in the second group, and a few individual cases in the first, it is the relation of the alleged cause to the alleged or obvious effect that is most in dispute, and upon which medical evidence can throw most light.

It is obvious that injury to a living tissue may be recovered from without any apparent after effects ; or it may lead to pathological processes without any intervening period ; or it may lead to pathological processes which, or the effect of which, may not be observable for periods of varying lengths—that is to say, they may remain latent for considerable periods.

It follows that great difficulty may arise in assessing the relationship between the disability and the original injury especially where the time interval is prolonged. When, after an injury, a disease supervenes, which may quite well have occurred had there been no injury, the question whether the injury was a contributory or sole cause of the disease or of the death is difficult to decide ; for example, when tuberculosis occurs in the lung of a person who has received an injury to the chest ; or tuberculosis of the spinal vertebræ after a minor back injury, kidney disease after crush injuries, malignant growths of various kinds after trauma.

In many cases, the presence of pre-existing disease adds to the complexity of the issue, for it may have to be decided whether an injury caused a lighting up of a pre-existing disease focus.

In all such cases it must be shown that the origin of the disability or disease can be traced to the accident or that the accident is a contributing factor. It is not sufficient to show that the disease is a sequel to the accident or that such a disease has been known to follow a similar injury on other occasions. It must be established that the accident was the cause of the disease or that the weight of probability warrants the inference of causal relationship in the particular case. In general there should be a direct sequence in the march of events although we must be alive to the fact that a disease process, irritated by the injury, may be masked or deferred in its outward manifestations and thus lead to the erroneous assumption of complete recovery from the injury and a failure to appreciate any causal relationship between the one happening and the other.

When a tissue is damaged there may be no evidence of direct infection from the injury. There may be no open wound or other means of infection from without, yet the injury may predispose the tissue to infection owing to the lowering of the resistance in the damaged area and to increased permeability of the blood vessels in that area. It has been shown that bacteria in the blood stream more readily infect an area of damaged tissue, although the conditions required for the effective growth in such cases are by no means clear. Certain it is that it is not necessarily severe injuries which lead to such complications, for the great increase in blood and lymph in severe injuries may in fact increase the resistance of the part ; but, on the contrary, minor lesions may readily lead to those conditions of diminished resistance which result in the onset of disease.

Incapacity and the Question of Operation. There are two stages in an accident when this question may arise : (1) during the acute processes following an injury ; (2) in the stage when nature's healing is completed, and an operation is suggested to correct a deformity or to remove a useless and possibly obstructive part of the man's anatomy.

In the first stage the operation is merely a part of the treatment of the injury, such treatment having for its object the most rapid healing of the parts and the avoidance of complications which might be dangerous to life.

In cases of this nature it would seem that there is only one reasonable principle which should guide the courts, *viz.*, to accept as final and decisive the opinion of the medical man who was attending the case at the time, including of course any consultant who may have been called in. In such circumstances, a medical man's sole object is to do the best he can according to his "reasonable skill and care" to cure his patient as speedily as possible, and refusal to consent to treatment should be considered as "contributory negligence."

In the second stage, it is helpful to consider what a reasonable private patient would do in similar circumstances. Obviously he would endeavour in the first place to get the best advice obtainable on the subject. Having obtained this, he would weigh and consider it, and either act on it or put up with the consequences of disregarding it. If the workman cannot obtain such skilled advice, a judge can obtain it both for the benefit of the workman and also for his own assistance.

Four considerations should be borne in mind, *viz.*, (1) whether the operation is difficult or simple; (2) whether, if performed, it will effect the purpose in view; (3) whether there is any risk owing to the necessary administration of an anæsthetic; (4) what is medical opinion as to the advisability of the operation.

For a complete discussion as to the scope which the law of compensation affords for medical evidence and for the detection of malingerers, the reader is referred to a volume on the Workmen's Compensation Acts, edited by Douglas Knocker, to Jones and Llewellyn's text-book on "Malingering," to Sir John Collie's work on "Medical Examinations under the Workmen's Compensation Acts," and to Fraser's "Trauma, Disease and Compensation."

INDUSTRIAL DISEASES DIRECTLY DUE TO THE NATURE OF THE EMPLOYMENT

The Workmen's Compensation Acts provide that in the circumstances specified therein certain industrial diseases are regarded for purposes of compensation as personal injuries by accident arising out of and in the course of employment.

For the full list of scheduled diseases which are included under the heading of "Industrial Diseases," the reader is referred to the Third Schedule of the Workmen's Compensation Act, 1925, and to the several Orders made from time to time by statutory authority.

CERTIFYING SURGEONS AND MEDICAL REFEREES

The Home Secretary is empowered to make rules regulating the duties and fees of certifying and other surgeons (including dentists). The latest Regulations should always be consulted in any case in which a medical practitioner is interested as a certifying surgeon or otherwise.

Regulations as to Medical Referees have been made by the Home Secretary and are published as Statutory Rules and Orders. The latest Regulations and the latest edition of a standard work on the Workmen's

Compensation Acts should be consulted in any case in which a medical practitioner is concerned as medical referee or otherwise.

Where a medical referee has been employed as a medical practitioner in connection with any case by or on behalf of an employer or a workman or by any insurers interested, he is not permitted to act as medical referee in that case.

The attention of medical referees is drawn to the clauses of their certificate of appointment wherein they are advised not to act in a private capacity in any cases under the Act, *i.e.*, as medical witnesses for either side. Medical referees should of course be free from any partisan considerations, so as to be in a position to act with judicial impartiality.

CHAPTER XVIII

INSANITY

Synopsis of the matters discussed in the following pages :—

Insanity in General

The executive of the Lunacy and Mental Treatment Acts, 1890 to 1930.

What is insanity ?

The diagnosis of early cases.

Insanity in Relation to the Law

Legal definitions of insanity.
Certification of the insane.
How the insane can be placed under treatment.
    Reception orders of various kinds.
    Medical certification.
Escape and discharge of certified patients.
The Mental Deficiency Acts, 1913 to 1938.
Legal responsibility of the insane.
    (i) As a witness.
    (ii) In marriage.
    (iii) In contract.
    (iv) In tort.[1]
    (v) Testamentary capacity.
    (vi) Criminal responsibility.
Responsibility of drunken persons.
    Diagnosis of drunkenness.
    Intoxication other than alcoholic.
Medical views on responsibility of drunken persons.
    Legal views on responsibility of drunken persons.
    Civil responsibility of drunken persons.
    Criminal responsibility of drunken persons.
    Restraint of habitual drunkards.
Feigned insanity.
Feigned deaf-mutism.

The Executive in Insanity

The Lunacy and Mental Treatment Acts, 1890 to 1930, are the principal statutes which deal with the treatment and detention of insane persons and with the management of their property; and the Mental Deficiency Acts, 1913 to 1938, deal similarly with the care, training and control of mental defectives.

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[1] Sir Hugh Fraser, in his work on the Law of Torts, said that to define a tort is difficult and unsatisfactory : a good description is :—A tort is an infringement of a general right or right *in rem.*

The following authorities set up by the Lunacy and Mental Treatment Acts, 1890 to 1930, are responsible for the due administration of the statute law relating to persons of unsound mind.

(i) The Lord Chancellor (associated with other judges).
(ii) The master in lunacy.
(iii) The Board of Control.
(iv) Local authorities.
(v) All "judicial authorities."
(vi) Medical officers of mental hospitals.[1]
(vii) Any qualified medical practitioner who is called in to perform an official duty.

The Lord Chancellor, as judge in lunacy, is entrusted with the care of the person and estates of persons of unsound mind. He acts either alone or jointly with one or more of the judges of the Supreme Court who have been entrusted with such duties. The judge in lunacy may make orders for the custody of persons of unsound mind so found by inquisition and for the management of their estates. Under the control of the judge in lunacy is the master in lunacy who must be a barrister of not less than ten years' standing.

The Board of Control regulates the affairs of institutions for the reception of persons of unsound mind and mental defectives; and it supervises such persons of unsound mind as are not so found by inquisition. By the Mental Treatment Act, 1930, the Board consists of a chairman (who is a paid commissioner) and not more than four other paid commissioners (one of whom at least must be a woman). Public persons of unsound mind—*i.e.*, rate-aided and criminal lunatics [2]—are detained in county or borough mental hospitals or in a criminal lunatic asylum. The local authority may provide mental hospital accommodation for rate-aided and private patients, together or in separate mental hospitals, and may provide separate mental hospitals for idiots. A "rate-aided patient" cannot be allowed to remain in a poor law institution as a person of unsound mind, unless the medical officer of the poor law institution certifies that he is a proper person to be allowed to remain in a poor-law institution as a person of unsound mind, and that the accommodation of the poor law institution is sufficient for his proper care and treatment. Private persons of unsound mind—*i.e.*, persons of unsound mind other than those so found by inquisition, rate-aided persons of unsound mind, and criminal lunatics [2]—may receive treatment in registered hospitals, licensed houses, county and borough mental hospitals, or in private houses as single patients; but the Board of Control may sanction the reception of more than one person of unsound mind in a house in special circumstances, and for the benefit of single patients.

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[1] By sect. 20 of the Mental Treatment Act, 1930, the new terms "mental hospital," "rate-aided person" or "person of unsound mind" or "patient," or "patient of unsound mind" are substituted for the former expressions, "asylum," "pauper," and "lunatic," respectively.

[2] By the same section the phrase "criminal lunatic" is retained.

Local authorities have various administrative duties placed upon them, including the provision of mental hospitals, and powers (under the Act of 1930) to provide out-patient departments for the treatment of mental illness and to arrange for the after-care of discharged patients.

What is Insanity ?

It is quite impossible to define the term insanity with any precision, for there is no definite dividing line between sanity and insanity—one state passing imperceptibly into the other.

The term insanity as ordinarily used connotes a fairly advanced degree of disorder or unsoundness of the mind. It has to be noted, however, that certain types of insanity, for example, moral insanity, may co-exist with an apparently ordered mind. It is by means of the mind that an individual is able to adapt himself to his environment, and thus disorder or disease of the mind is shown primarily in disorder of thought and disorder of conduct. When that conduct becomes sufficiently disordered to bring the individual into conflict with his environment, the law takes steps to place the person under care and restraint.

The following terms are commonly used in describing disorders of observable conduct.

Dementia, when deep, consists in the absence of all the high levels of the faculties. Memory is for the most part absent also ; only the lowest levels remain—sexual and crude self-preservative desires, trivial efforts of will ; feelings of a crude nature are left, and some simple sensations. It commences in the upper levels of all faculties, and its progress is marked by the loss of each level from above downwards.

Depression, or dysphoria, or misery in various degrees, is obviously not necessarily a sign of madness, for it may be justified ; but the less justification there is for it the greater the suspicion that it implies insanity. If there is no justification, and if it is not recognised by the victim to be unjustified and cannot be controlled by reason, it indicates insanity. It may be known by him to be unjustified, and it may still be uncontrollable, but he is still not insane if he recognises that it is unjustified.

Exaltation (to be distinguished from excitement) is a disturbance or disorder of subjective thought. We judge its sanity by noting whether it is justified ; if it is not justified, by noting whether the patient knows that it is unjustified.

Excitement and stupor are disorders of conduct. In both of them we presume that there is corresponding disorder of mind, but in excitement, there is, in the absence of justification by circumstances, no need to determine the disorder of mind, while in stupor the state of the mind cannot be determined for want of response on the part of the patient ; but when the patient recovers he is, in some cases, able to tell us that his intellect was not disordered, but that his will was paralysed.

Delusions, *i.e.*, wrong beliefs, removable by evidence, are everyday occurrences in the sane. When they cannot be removed by the plainest contradictory evidence they are disturbances of the highest levels of feeling and thought, objective or subjective, and imply insanity because they are disturbances of the highest mental processes.

Illusions, or false perceptions of external stimuli or objects, are disturbances of the lower levels of objective feeling and thought, and commonly occur in sane people; if they are not removable by evidence, they are insane, and *ipso facto* become delusions.

Hallucinations, or responses to some imagined external stimulus, are at the same level as illusions, but belong more to the subjective side of feeling and thought. They may be considered sane or insane by the same criteria as illusions.

Moral insanity or depravity is a disturbance of the upper levels of feeling and thought. Inasmuch as the disturbance may not affect the highest levels of intelligence, the distinction between sane and insane moral depravity is often difficult; the essential distinction lying in the determination of whether the victim does or does not realise the turpitude of his conduct, a discrimination not always easy to arrive at.

Impulse is a phase of conduct, a sudden unpremeditated act usually excessive; being unpremeditated it is undertaken without proper—perhaps without any—prevision of consequence. It is not permissible to speak of an uncontrollable impulse; all we can know about it is that it was not controlled, we cannot know whether it could have been. Insane impulses are very common amongst epileptic insane, and thus not infrequently are violently destructive of life or property.

By the Mental Deficiency Acts, 1913 to 1938, idiots, imbeciles, feeble-minded persons, and moral imbeciles are thus defined:

> The following classes of persons who are mentally defective are deemed to be defectives within the meaning of the Acts.
>
> (*a*) Idiots: that is to say, persons in whose case there exists from birth or from an early age, mental defectiveness of such a degree that they are unable to guard themselves against common physical danger.
>
> (*b*) Imbeciles; that is to say, persons in whose case there exists from birth or from an early age, mental defectiveness which though not amounting to idiocy is yet so pronounced that they are incapable of managing themselves or their affairs, or, in the case of children, of being taught to do so.
>
> (*c*) Feeble-minded persons; that is to say, persons in whose case there exists from birth or from an early age, mental defectiveness which, though not amounting to imbecility, is yet so pronounced that they require care, supervision, and control for their own protection or for the protection of others, or, in the case of children, that they appear to be permanently incapable by reason of such defectiveness of receiving proper benefit from the instruction in ordinary schools.
>
> (*d*) Moral imbeciles; that is to say, persons in whose case there exists mental defectiveness, coupled with strongly vicious or criminal propensities, and who require care, supervision and control for the protection of others.

Delirium (or stupor) of ordinary bodily diseases. This has hitherto been separated from insanity, but the distinction can no longer be maintained. A delirous patient (from typhoid fever, scarlet fever, pneumonia, uræmia, etc.) is insane for the time being, and indeed in some chronic bodily complaints the conduct has been such as to lead a medical man to overlook the bodily disease and to certify the patient as suffering from insanity only. It is obviously impossible to enter here upon a discussion of the differential diagnosis between the conditions, but the point must not be overlooked. The causes of insanity are many and varied, and amongst them are many bodily diseases.

Diagnosis of Insanity in Early or Less Marked Cases. It is by no means easy to decide in the early stages of mental disease whether a person is sane or insane; for the factors responsible for morbid states of the mind are complex and little understood. In many cases the deviation from the normal is so slight that it cannot possibly be diagnosed.

Psychiatry has now advanced to such a stage that no good purpose can be served in attempting to deal in detail with the diagnosis of mental disease in this work, and the reader is referred to modern works on this special subject.

INSANITY IN RELATION TO THE LAW

"The English law is complex, both in civil and criminal cases, with regard to insanity. About eight different tests apply in civil cases, such as to wills, contracts, assignments, and other matters."[1]

Under the Lunacy and Mental Treatment Acts, 1890 to 1930, provision is made for the treatment of three classes of mental patients; namely (*i*) voluntary patients, (*ii*) temporary patients, and (*iii*) certified patients.

(*i*) *Voluntary Patients*

Anyone *over* sixteen years of age who makes written application to the person in charge, may be received as a voluntary patient in any institution, as defined by the Mental Treatment Act of 1930, or in any hospital, nursing home or other place approved by the Board of Control, or as a single patient into the care of any person so approved. No medical practitioner need intervene.

A person *under* sixteen years of age may be received as a voluntary patient, as above, only if his parent or guardian makes a written application for the purpose to the person in charge as above, accompanied by a recommendation from—

(*a*) The patient's usual medical attendant, or

(*b*) One of the practitioners approved by the Board of Control, or by the local authority of the patient's area.

A voluntary patient must be released within seventy-two hours of the receipt of a written request from himself or, if under sixteen, from his parent or guardian. If a voluntary patient becomes worse, so as to be unable to express himself as willing or unwilling to stay, he must be discharged within twenty-eight days, unless—

(*a*) He has sufficiently recovered to express willingness or unwillingness to stay.

(*b*) He has been recommended according to the method described below as being likely to benefit by temporary treatment.

(*c*) He has been certified as of unsound mind.

(*ii*) *Temporary Patients* (*without certification*)

If a patient suffering from mental disorder is incapable of expressing himself as willing or unwilling to receive treatment, and is likely to benefit by temporary treatment, he may be received on a written application by a relative or by a duly authorised officer of the local authority, but without certification, into a mental or registered hospital or other institution or nursing home approved by the Board of Control, or under charge as a single patient with the consent of the Board of Control.

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[1] Mr. Justice McCardie in *R.* v *True* (*infra*).

The application must be accompanied by a recommendation signed by two medical practitioners, one if possible, being the patient's usual medical attendant, the other being one of the practitioners approved by the Board of Control. These practitioners may examine the patient either conjointly or separately within five days of each other, and their recommendation holds good for fourteen days only.

Such patients may be retained for six months ; and if early recovery seems possible, for two further periods of three months, but not exceeding twelve months in all. If meanwhile the patient becomes capable of expressing himself willing or unwilling to receive treatment, he may not be detained against his will for more than twenty-eight days, unless in the meantime he has again become incapable of expressing himself as willing or unwilling to receive treatment.

Adequate security is provided by the Statute for visiting and supervising these patients.

(*iii*) *Certified Patients*

Although final disappearance from the world is no longer the fate of a certified patient who is sent to a mental hospital, certification involves the loss of a good deal of that personal liberty which in English law is the right of every man, and is not to be taken away except for serious misconduct. Moreover, there is the stigma of being officially declared to be a person of unsound mind which may remain as an unwelcome legacy to the family ; it is therefore no light matter to certify a person as insane and to cause him to be received into a mental hospital. " Good faith and reasonable care " on the part of the certifier are required here in a greater degree than is necessary, perhaps, anywhere else in the activities of a medical practitioner.[1]

When considering the question whether or not a person should be certified, two interests should be borne in mind ; *viz.*, (*a*) that of the physician who is asked to certify, and (*b*) the interests of the patient. These are dealt with in order.

The Interests of the Medical Man. The following sections of the Lunacy Act, 1890, show the responsibility and liability of a medical man who is asked to certify a person as a person of unsound mind :—

" Sect. 28. (2) *Every medical certificate upon which a reception order is founded shall state the facts upon which the certifying medical practitioner has formed his opinion that the alleged person of unsound*

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[1] In a case where damages were claimed against two medical practitioners for alleged negligence in certifying a mental case, Lord Justice Scrutton referred to the duty of the courts to hold the balance fairly between the desire to protect the liberty of the subject on the one hand, and, on the other, the desire to protect the physicians who are called upon by Parliament to exercise for the good of the community the duty of honestly expressing their opinion about patients. (*B.M.J.*, 1929, II., 1226.)

mind is a person of unsound mind, distinguishing facts observed by himself from facts communicated by others; and a reception order shall not be made upon a certificate founded only upon facts communicated by others.

" (3) *The medical certificate accompanying an urgency order shall contain a statement that it is expedient for the welfare of the alleged person of unsound mind or for the public safety that he should be forthwith placed under care and treatment, with the reasons for such statement.*

" (4) *Every medical certificate made under and for the purposes of this Act shall be evidence of the facts therein appearing and of the judgment therein stated to have been formed by the certifying medical practitioners on such facts, as if the matters therein appearing had been verified on oath.*

" Sect. 29. (1) *A reception order shall not be made unless the medical practitioner who signs the medical certificate, or where two certificates are required, each medical practitioner who signs a certificate, has personally examined the alleged person of unsound mind in the case of an order upon petition not more than seven clear days before the date of the presentation of the petition, and in all other cases not more than seven clear days before the date of the order.*

" (2) *Where two medical certificates are required, a reception order shall not be made unless each medical practitioner signing a certificate has examined the alleged person of unsound mind separately from the other.*

" (3) *In the case of an urgency order, the person of unsound mind shall not be received under the order unless it appears by the medical certificate accompanying the order that the certifying medical practitioner has personally examined the alleged person of unsound mind not more than two clear days before his reception.*

" Sect. 317. (1) *Any person who makes a wilful misstatement of any material fact in any petition, statement of particulars, or reception order under this Act, shall be guilty of a misdemeanour.*

" (2) *Any person who makes a wilful misstatement of any material fact in any medical or other certificate, or in any statement or report of bodily or mental condition under this Act, shall be guilty of a misdemeanour.*

" (3) *A prosecution for a misdemeanour under this section shall not take place except by order of the Commissioners, or by the direction of the Attorney-General or the Director of Public Prosecutions.*

" Sect. 330 **(as amended by the Mental Treatment Act, 1930, sect. 16.)** (1) *Where a person has presented a petition for a reception order, or signed or carried out, or done any act with a view to signing or carrying out, an order purporting to be a reception order or any report, application, recommendation, or certificate purporting to be a report, application, recommendation, or certificate under this Act, or any Act amending this Act, or has done anything in pursuance of this Act, or any Act amending this Act, he shall not be liable to any civil or criminal proceedings, whether on the ground of want of jurisdiction or on any other ground unless he has acted in bad faith or without reasonable care.*

" (2) *No proceedings, civil or criminal, shall be brought against any person in any court in respect of such matter as mentioned in the last* *preceding subsection, without the leave of the High Court; and leave shall not be given unless the court is satisfied that there is substantial ground for the contention that the person against whom it is sought to bring the proceedings has acted in bad faith or without reasonable care.*

" (3) *Notice of any application under the last preceding subsection shall be given to the person against whom it is sought to bring the proceedings, and that person shall be entitled to be heard against the application.*

" (4) *Where on an application under this section leave is given to bring any proceedings, and the proceedings are commenced within four weeks after the date on which leave was so given, the proceedings shall for the purposes of the Public Authorities Protection Act,* 1893, *be deemed to have been commenced on the date on which notice of the application was given to the person against whom the proceedings are to be brought.*

" Sect. 331. (1) *Any action brought by any person who has been detained as a person of unsound mind against any person for anything done under this Act shall be commenced before the expiration of one year from the release of the party bringing the action, and shall be laid or brought in the county or borough where the cause of action arose, and not elsewhere. (See the Limitation Act,* 1939, *s.* 21).

" (2) *If the action is brought in any other county or borough or is not commenced within the time limited for bringing the same, judgment shall be given for the defendant.*

There can, however, be no excuse for non-compliance with the strict letter of the above sections. In regard to the spirit of sect. 28 (2), attention is drawn to the fact that, except in very acute cases (delirium tremens, acute mania, and a few others), as a rule, the first step is taken and a request for a certificate is made by a person who is very materially interested in the case; and although it is true that such interest may be dictated by the most sacred of all motives, *i.e.*, love and affection, yet it is possible that other motives may be operating; hence the necessity for " facts observed by myself," because interested evidence is always tainted with suspicion.

The following questions are typical of those commonly asked in cross-examination of a medical man who may be called upon to defend an action for alleged negligence in the certification of a patient: Knowing the disabilities and unpleasantnesses for the patient attendant on certification, did you try any or all other steps short of this extreme one? Did you consider the welfare of the patient, and whether this could be best secured by certification? Did you believe that a mental hospital frequently gives the best chance of recovery? What steps did you try? (This applies particularly to acute cases of temporary duration, such, for instance, as delirium tremens).

One further caution in this connection which may be given to a medical man is that, where he finds it necessary or advisable to use force to restrain a raving patient, he should obtain a written authority from a relative or guardian to do so, taking care even then not to exceed what is necessary in this respect. The absence of such an authorisation has placed a medical man in a position of difficulty. Sect. 40 (" Mechanical Restraint ") of the Lunacy Act of 1890 should be read in this connection.

In *Harnett* v. *Fisher*[1] the jury found that at the date when Dr. Fisher certified Harnett the patient was not of unsound mind and that Dr. Fisher had not acted with reasonable care, and they awarded £500 damages. The House of Lords held that the Limitations Act, 1623 applied ; and that in view of the finding of the jury, Harnett could not maintain within the disability section of the Statute of 1623, that he was *non compos mentis* during his detention ; and that consequently the action was barred six years after the date of the certificate.

By sect. 16 of the Mental Treatment Act, 1930, a medical practitioner who signs a reception order or certificate, shall not be liable to any civil or criminal proceedings unless he has acted in bad faith or without reasonable care ; and by the same section, no such proceedings shall be instituted without the leave of the High Court, and such leave shall not be given unless the Court is satisfied that there is substantial ground for instituting the said proceedings.[2]

The Interests of the Patient. To quote those sections of the Act which bear on this aspect of our question would be to print nearly the whole of the Act of 1890, for that Act was passed in these interests, *viz.*, to ensure that the lot of a certified patient should be more reasonably comfortable. Whereas it was formerly the main object to put a certified patient out of sight, the object now is to treat him with a view to the amelioration of his condition.

There is no doubt that every person of unsound mind ought to be taken care of ; but between being taken care of and being certified and placed in a mental hospital as a certified patient, there are many grades of management which have now been recognised and provided for by Parliament in the Mental Treatment Act, 1930 (*supra*). There are many harmless patients who are well managed, nursed, looked after, and treated in their own homes and by their own friends, and in respect of whom unless payment is made for their care, the formality of certification is unnecessary and undesirable, unless suspicion arises that they are not being fairly treated.

The real crux of the problem concerning the interests of the patient arises from those portions of the Lunacy and Mental Treatment Acts, 1890 to 1930, which deal with single cases and with unlicensed houses, and from that class of case which has received the name of " borderland "—a class where folly, mental weakness, vice, and insanity are mingled in varying proportions. (See the Mental Treatment Act, 1930, for provisions as to voluntary patients and temporary patients.)

In this connexion, the following sections of the Lunacy Act, 1890, are relevant :—

" Sect. 4. (1) *Subject to the exceptions in this Act mentioned, a person, not being rate-aided or a person of unsound mind so found by inquisition, shall not be received and detained as a person of unsound mind in an institution for persons of unsound mind or as a single patient, unless under a reception order made by the judicial authority hereinafter mentioned.*"

" Sect. 315. (1) *Every person who, except under the provisions of this Act, receives or detains a person of unsound mind, or alleged person*

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[1] (1927) A.C. 573.

[2] See case reported in (1936) 2 All E.R. 182.

of unsound mind, in an institution for persons of unsound mind, or for payment takes charge of, receives to board or lodge, or detains a person of unsound mind or alleged person of unsound mind in an unlicensed house, shall be guilty of a misdemeanour, and in the latter case shall also be liable to a penalty not exceeding fifty pounds.

" (2) *Except under the provisions of this Act, it shall not be unlawful for any person to receive or detain two or more persons of unsound mind in any house unless the house is an institution for persons of unsound mind or workhouse.*

" (3) *Any person who receives or detains two or more persons of unsound mind in any house, except as aforesaid, shall be guilty of a misdemeanour.*"

It is under these sections that proceedings against medical practitioners are taken in the rare cases which now occur.

How can a Certified Patient be received into a Mental Institution ?

The Lunacy and Mental Treatment Acts, 1890 to 1930, provide for the care and treatment of persons of unsound mind ; and the Mental Treatment Act, 1930, made drastic and far-reaching changes in the law for the institutional and other treatment of persons suffering from mental disorder (see p. 632 *supra*). The Mental Treatment Rules, 1930, supersede all previous Rules made by the Board of Control.

Whatever may be the social position of a certified patient (in contradistinction to a *voluntary* or *temporary* patient) or whatever the nature of his mental derangement, except he be an idiot (*vide* next paragraph), he can be received into a mental hospital or institution **only upon a reception or urgency order.** Of this order must be noted :—

1. Its varieties.
2. Who must sign it ?
3. What documents must accompany it ?
4. How is it to be *obtained* ?

[Mental defectives are dealt with by separate enactments, *viz.*, the Mental Deficiency Acts, 1913 to 1938.]

For the sake of clearness, the orders for reception may be tabulated, as follows.

Definition of Terms used in the Table

(*a*) " The judicial authority " is defined in the Act of 1890, sect. 9, to be a justice of the peace specially appointed for the purpose. or a judge of county courts, or a magistrate. Lists of judicial authorities are published.

(*b*) " Statement of Particulars." This is the formal document, Form 2 (of which printed copies can always be obtained from the place to which it is proposed to send the person), which sets out precisely the name and previous history of the patient—in other words, the particulars of the case up to the present attack.

(*c*) Committee [1] of the Person. When once a patient has been found by inquisition to be of unsound mind, a committee of his person may be appointed. A committee has sole control of person or estate, or both, subject only to the authority that appointed him, to whom he must make periodical reports.

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[1] This word is spelled like Committēē, but is pronounced Committee.

Orders for Reception

Variety.	Signed by	Accompanying Documents.	How obtained.	Remains in force.
1. Urgency. Lunacy Act, 1890, s. 11. N.B. This section is now of general application.[1]	If private, nearest relative (if possible); if rate aided, duly authorised officer of local authority.	Statement of particulars. One medical certificate.	By signing the order	Seven days only from date of order unless petition pending.
2. On petition. Sect. 4.	Specially appointed Justice	Statement of particulars. Two medical certificates.	By presenting a petition from relatives.	For one year. Must then be renewed.[2]
3. Summary reception order. Non-rate-aided persons. Sect. 13.	Specially appointed Justice.	Statement of particulars. Two medical certificates.	Information from a relieving officer or constable, etc.	
4. Order for a person of unsound mind wandering at large Sect. 15.	A Justice of the Peace.	Statement of particulars. One medical certificate.	Information from a relieving officer or constable, etc.	
5. Order by One Commissioner. Sect. 23.	One Commissioner.	One medical certificate.	On the initiative of one of the Board of Control.	
6. Reception order for rate-aided persons. Sects. 14 and 16.	A Justice of the Peace.	Statement of particulars. One medical certificate.	Information from a relieving officer.	
7. After inquisition. Sect. 90.	Committee or Master.	Office copy of order appointing committee or order of Master.	Upon application to the Court.	Until superseded.

Urgency. This implies that there is a danger that, if the patient be not speedily placed under control, some serious damage may result either to the patient, or to those taking care of him, or to the public (*e.g.*, in a hotel, ship, boarding-house, etc.), and this must be made clear in the certificate.

To prevent abuse of such great powers over the person, the law requires (i) that in the case of a private patient, the person signing such order shall be the nearest relative, or if not, that very good reasons shall be given why such person does not sign, and in the case of a rate-aided patient, a duly authorised officer of the local authority; (ii) that the person must be twenty-one years of age, and therefore can be made fully responsible for his actions; and (iii) that the person signing must have seen the patient within two days—a measure of the urgency of the case. The order remains in force seven days only, unless in the meantime the more ordinary means for restraining the patient (petition usually), have been at least initiated, and then the order remains in force until completion of the petition.

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[1] In consequence of amendment by the Mental Treatment Act, 1930, s. 17.

[2] A reception order must be renewed at the end of the first, second, fourth and seventh years and every five years thereafter.

Inasmuch as it will most frequently be upon a medical man that the responsibility for an urgency order will rest, a few words of advice are added. Urgency may arise in connection with acute mania, and this is of two kinds: *viz.*, (i) that attributable to distinctly recoverable causes, such as alcoholic and other toxic conditions, deliriant poisons, acute pyrexial disease, etc.; (ii) that attributable to no apparent removable cause—*i.e.*, purely mental in origin, so to speak; hence the need to endeavour to ascertain the cause of the outbreak. In the eyes of many people, certification as a person of unsound mind inflicts a stigma which can never be removed, and remains for the life of the patient and as a legacy to the children and relatives; every possible chance of simple nursing and watching which the circumstances of the case permit should, therefore, be exhausted before taking the serious step of "certifying." In these cases the law affords to medical men comparatively little protection; and, if the patient recovers (as not infrequently happens in cases of *delirium tremens*, etc.), the certifying physician may have great difficulty in proving that he exhausted every other possibility before certifying, having regard to the welfare of the patient, and the safety of the public. Among those who can afford to pay, it is the rule that sufficient nursing skill can be obtained; but in the poorer classes, it is often difficult; and inasmuch as after recovery such people are often vindictive, a medical man should secure from a responsible relative or friend of the patient a guarantee or indemnity in respect of all future proceedings and expenses. In cases where the patient is actively suicidal, sexually immoral, etc., it may be necessary speedily to isolate him, not only for his own welfare, but also for the safety of the public.

Petition. This is the most usual course when dealing with patients where "urgency" is not pleaded. The petition must be signed by the nearest relative, or a valid reason given for the fact that some one else has signed it; the person signing must be twenty-one years of age, and must have seen the patient within fourteen days. Together with the accompanying documents shown in the table, it must be presented to a judicial authority, who thereupon considers the allegations of the petition, the statement of particulars, and the evidence of insanity appearing on the medical certificates, and whether it is necessary for him to see and to examine the person of alleged unsound mind; and if he is satisfied that an order may properly be made forthwith, he makes it. If not satisfied, he appoints a time, not more than seven days after the presentation of the petition, for its consideration; and in the meantime he may make inquiries. If he is not satisfied with the evidence of insanity appearing on the medical certificates, he may also visit the person of alleged unsound mind.

When the petition is considered, this takes place in private, and no one, except with the leave of the judicial authority, is allowed to be present except the petitioner, the person alleged to be of unsound mind (unless the judicial authority shall in his discretion otherwise order), any one person appointed by the person of unsound mind for that purpose, and the persons signing the medical certificates; and all, except the person alleged to be of unsound mind and his nominee, are bound to secrecy. The judicial authority may dismiss the petition, giving his reasons to the petitioner in writing, and must send a copy to the Board of Control; or he may adjourn the consideration for not more than fourteen days; or he may make the *reception order*, on the strength of which the person of unsound mind may be admitted into an institution, or be received into a house as a single patient.

Summary Reception Orders

> "Every constable or relieving officer, who has knowledge that any person within his district or parish who is not a rate-aided person and not wandering at large is deemed to be a person of unsound mind and is not under proper care and control, or is cruelly treated or neglected by those in charge of him, shall within three days give information on oath to a judicial authority.'

Such judicial authority shall direct two medical practitioners to examine the patient and, if necessary, to certify him as insane, and shall then proceed as if a petition had been presented to him. The constable, or relieving officer, may be said to take the place of a petitioner in ordinary cases.

Persons of Unsound Mind wandering at Large. The constable or relieving officer "must apprehend such wanderer, either on his own initiative or by order of a justice," who then acts similarly to petition cases, except that only one medical certificate is required, and he must see the patient. The wanderer may be detained in the poor law institution not longer than three days, if his welfare or the public safety demand it, without the order of a justice, a modified urgency proceeding which must be replaced by proper inquiry by the end of the three days.

Rate-aided Persons of Unsound Mind. The medical officer of a poor law district is in some respects the guardian of the mental condition of rate-aided persons; and it is his business, when he becomes aware of the existence of a rate-aided person of unsound mind, to give notice to a relieving officer. In these cases the statement of particulars must be signed by the person giving information to the justice.

A person of unsound mind cannot be legally detained except as a temporary patient or by judicial order; and such detention must be in either a licensed house, a registered hospital, a mental hospital, or as a single patient; in all of which circumstances the Board of Control is bound to inspect from time to time.

If a patient admitted under an order upon petition has not been seen by a judicial authority before the reception order is made, he is entitled to be given notice of his right to an interview (sect. 8); and notice that he is so entitled must be given within twenty-four hours after his reception, unless the medical officer certifies within the same period that such interview would be prejudicial to the patient's welfare

All the above processes are concerned with the person only of the patient. The method by which the property as well as the person of a patient may be taken care of, if necessary, is as follows :—

Inquisition. Prior to the Lunacy Act, 1890, this process was confined almost entirely to the rich. It was always an expensive procedure, but that Act has modified the position materially by entrusting to the judge, to the master and to the Board of Control much wider powers in regard to procedure.

Sect. 116, sub-section (1) of the Lunacy Act, 1890, makes the judge in lunacy the trustee of all the property of all persons found insane (paras. (*a*), (*c*), and (*f*)), and sub-sects. (*d*) and (*e*) simplify the "finding of insanity" by requiring it merely to be to the satisfaction of the judge "by affidavit or otherwise" for purposes of protecting property without reference to the care of the person, which is not dealt with by the section except so far as the power of the purse may regulate it.

It is beyond the scope of this work to deal in detail with the treatment and discharge of persons of unsound mind ; for these the reader is referred to the Lunacy and Mental Treatment Acts, 1890 to 1930, which, with the rules made under them, should be possessed by every medical practitioner so as to be available for immediate reference.

The Medical Certificate

The certificate is as follows :—

Certificate of Medical Practitioner

(53 Vict. c. 5.—Sched. 2, Form 8.)

In the matter of

(*a*) *Insert residence of patient.*

of (*a*)

(*b*) County, city, *or* borough, *as the case may be.*

in the (*b*)

(*c*) *Insert profession or occupation, if any.*

(*c*)

an alleged person of unsound mind

I, the undersigned,

do hereby certify as follows :—

(*d*) *Insert the place of examination, giving the name of the street, with number or name of house, or should there be no number, the Christian and surname of occupier.*

(*e*) County, city, *or* borough, *as the case may be.*

(*f*) *Omit this where only one certificate is required.*

1. I am a person registered under the Medical Act, 1858, and I am in the actual practice of the medical profession.

2. On the day of 1
at (*d*)
in the (*e*) of (separately from any other practitioner) (*f*) I personally examined the said
and came to the conclusion that he is (*g*)

and a proper person to be taken charge of and detained under care and treatment.

(*g*) An idiot, *or* a person of unsound mind.

3. I formed this conclusion on the following grounds, *viz.* :—

(a) Facts indicating Insanity observed by myself *at the time* of examination (*h*), *viz.* :—

(*h*) *If the same or other facts were observed previous to the time of the examination, the certifier is at liberty to subjoin them in a separate paragraph.*

(*i*) *The names and Christian names (if known) of informants to be given, with their addresses and descriptions.*

(b) Facts communicated by others (*i*), *viz.* :—

* *Or* not to be.

4. The said
appeared to me to be *
in a fit condition of bodily health to be removed to a mental hospital, hospital, or licensed house (*k*).

(*k*) *Strike out this clause in case of a patient whose removal is not proposed.*

5. I give this certificate having first read the section of the Act of Parliament printed below.

(Signed)
of (*l*)
Dated this day of 1

(*l*) *Insert full postal address.*

An important footnote is thus given—

(53 Vict. c. 5, ss. 4, 11, 16, 28, 29.)

> Any person who makes a wilful misstatement of any material fact in any medical or other certificate, or in any statement or report of bodily or mental condition under this Act shall be guilty of a misdemeanour.—*Extract from Sect.* 317 *of the Lunacy Act*, 1890.

In this certificate there are several points which require to be mentioned specially, as inattention thereto has been the cause, frequently, not only of the certificate being returned for emendation—a small but annoying matter (*experto crede*)—but also of much more serious trouble to medical men in the form of legal proceedings.

1. As a general statement, it must be remembered that at the beginning of the proceedings the petition, and the circumstances in which it is presented, the "statement of particulars," and the medical certificates are, as a rule, the only evidence which a judicial authority or a Commissioner possesses as to the mental condition of a patient, or even as to the existence of such a person. For these reasons, verbal accuracy in spelling is essential; it may seem absurd to have a certificate returned for the insertion of a final "e" in Smythe, for instance, yet such might prove to be a serious error; and if proper names were permitted to be spelled wrongly, it would not be possible to draw the line anywhere.

2. When two certificates are required, (*a*) each must be made and signed *as the result of an interview made separately from the other certifying medical practitioner*, *i.e.*, at a different time : (*b*) the two medical men must not be relatives or business partners of one another : (*c*) if possible one must be signed by the patient's usual medical attendant.

3. Each certificate must be made and signed by a medical practitioner himself, not by his substitute ; at least if a substitute does so make and sign it, he must be a registered medical practitioner, and must by so making and signing *assume to himself and not to his principal* full responsibility for all that he states (sects. 28 to 34).

4. In petitions, the medical practitioner who signs the certificate must be neither a relative nor a business partner of the petitioner.

5. In any and all cases the medical practitioner who signs a certificate of insanity, must not be interested pecuniarily in the place (institution or private house) to which the patient will be sent ; and he should not be related in any way to the medical superintendent.

6. The certifier cannot remain the medical attendant of (or on) the patient ; if a medical practitioner wishes to become or to remain the medical attendant of a patient, he must obtain an independent medical practitioner to certify the case.

7. In commissions of inquiry the evidence of a medical witness is similar to that which would be written in a certificate ; but it is obtained on the compulsion usual in courts of law, and is consequently privileged : therefore, so long as the facts are correct, a witness may advance any theories he may please without fear of an action for defamation. If such theories are to have any weight, they must be strong enough to bear very close cross-examination ; and must be unbiased by any personal feeling or motive.

8. The basis of the certificate is the "facts." A medical practitioner must not be too ready to sign certificates for the restraint of persons who may be labouring under harmless delusions. In violent mania, or in insanity with a homicidal or a suicidal propensity, there can be no doubt of the propriety of applying some degree of restraint. If a remarkable change in the conduct of the patient has suddenly taken place, if he has become irritable, outrageous, or has threatened personal violence, or if he has recklessly endangered the interests of himself and his family, he is undoubtedly a fit subject for restraint. The more he approaches to this condition, the less difficulty there is in coming to a decision ; and in a really doubtful case there will be no impropriety in employing restraint.

Medical practitioners have had some difficulty in assigning the fact or facts upon which is based their judgment of the insanity of a person. The words, "Facts indicating insanity observed by myself," are not properly appreciated or even understood by many medical men. Frequently the facts are stated in a loose and careless manner, indicating that there is a complete misapprehension of their meaning. What is required by the law is a statement of *facts* observed or witnessed by the medical man himself *at the time of examination*, which would carry conviction to the mind of any non-professional man who reads it, that the person to whom it referred was of unsound mind. In all cases a medical man should avoid giving as a fact indicating insanity any delusion which may have some foundation in truth. In regard to the second requirement of the statute, *i.e.*, " Other facts (if any) indicating insanity communicated by others," although these do not supersede the facts observed by the medical man himself, they are of great importance in throwing light upon the propensities or habits of the patient, and of recent alterations in habits and conduct. A medical man must take care to draw a clear distinction between the facts observed by himself and the facts communicated to him by others and also the facts observed by himself at the time of examination and facts observed previously; and he should avoid such vague expressions as " I think," " I believe," etc.

Inasmuch as every medical certificate, although accepted by the Board of Control, may become a subject for close and hostile criticism in court, a medical practitioner should be fully prepared to justify the use of any terms which he has employed. It is therefore desirable that he should studiously avoid any misstatement or exaggeration.[1]

No medical man is compelled to take upon himself the responsible duty of signing certificates of insanity; but if he does undertake it, he must perform it with reasonable care and ordinary skill. If he certifies that a person is labouring under delusions, illusions, or hallucinations, he must take care that he understands the meaning of the terms, and he should describe them; and, assuming that he is correct in believing from his own observation that such things exist in the mind of the patient, it must be remembered that, in order to justify certification, the law always looks to the influence of these delusions, etc., upon conduct.

As an illustration, a case of *delirium tremens* may be considered. The beetles, rats and mice which the patient sees running over the bed are *hallucinations*; if his own little dog comes into the room, and he thinks that it is the devil come to remove him, this is an *illusion*; when the nurse, by sweeping the bed, or calling the dog to be fondled by its master, tries to convince the patient that there is nothing on the quilt, and that " the devil " is his own pet; and, in spite of this, the patient *persists in his former beliefs*, this persistence is a *delusion* of such nature and degree as to constitute at least temporary insanity. In this connexion reference should be made to the provisions of s. 16 of the Mental Treatment Act, 1930, as to the burden of proof in cases of alleged unreasonableness in certification.

Position of Mental Patients Possessed of Property. The Management and Administration Department (formerly known as the Office of the Masters in Lunacy) is concerned with the management and administration of the property of all persons who are mentally incapable of managing their affairs.

The object is to afford protection to such mental patients (including Mental Defectives) during their illness. This protection extends to all patients possessed of property—

(*a*) Whether under treatment in Mental Hospitals or other Institutions under the Lunacy or Mental Deficiency Acts; or
(*b*) Whether under treatment in single care; or
(*c*) Residing in their own homes or elsewhere although *not* under certificate.

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[1] See *De Freville* v. *Dill*, 138 L.T. 83.

It is provided by the Lunacy and Mental Treatment Acts of 1890 to 1930, that a receiver of the patient's property may be appointed in any case where there is proof that, although he is not under treatment as a person of unsound mind, the patient is, through mental infirmity arising from disease or age, incapable of managing his affairs.

Powers of Attorney. Where a patient is possessed of property and is mentally incapable of managing his affairs, he is not in a position to give any power of attorney or other authority to manage his property; and any such authority so given is invalid and any such authority given prior to his illness becomes inoperative by reason of such incapacity. Any person continuing to act under any authority so given, or any bank or company in which the patient has money who permits any dealings with the same with knowledge of the patient's mental illness incurs considerable risk.

Receiver. Until a receiver is appointed there is no one in a position to give a discharge on behalf of the patient or to manage his property. The proper course, therefore, is to consult the Department as to the correct course to pursue in the particular circumstances and as to the necessity for the appointment of a receiver to act in the name and on behalf of the patient.

It may well be that in certain circumstances proceedings for the appointment of a receiver may not be insisted upon, *e.g.*, where trustees of a will or of a settlement under which the patient benefits have an absolute discretion to apply the income (or capital) of the trust fund for the maintenance and benefit of the patient during incapacity; but even in this class of case it is sometimes necessary to enquire on behalf of the patient as to how this discretion is being exercised.

Cases frequently occur where someone has been acting under an authority given by the patient prior to or since his incapacity, and subsequent investigation shows that either the property of the patient has not been managed in a satisfactory way, or that the patient has not been maintained in a manner suitable to his means and position. Again, experience goes to show that the realisation by the patient that his property is being protected often removes a source of worry.

The procedure has been greatly simplified, and a Personal Application Division has been established

Escape and Discharge of Certified Patients

If a certified patient escapes, he must be retaken within fourteen days; if he remains at large for more than fourteen days, the whole process of certification must be repeated before he can again be placed under restraint (sects. 85 to 89).

The petitioner (or, if he is incapable, his duly appointed substitute), may discharge a patient, provided that the medical officer who has the power to veto discharge in these circumstances does not oppose the discharge (sects. 72 and 74).

The Board of Control has the same power to release a patient, subject to the same veto (sect. 72 (3)); but Commissioners of the Board of Control have absolute power to order the discharge of a patient in a hospital or licensed house or of a single patient subject to certain consents (sect. 75).

The person who has charge of a person of unsound mind may liberate him on probation ; but this power does not extend to a person of unsound mind so found by inquisition.

Inquisitions may be superseded ; but the evidence must then be as strongly in favour of sanity as previously it was in favour of insanity.

Sects. 101 to 106 of the Lunacy Act, 1890, prescribe the means and powers of traversing or superseding an inquisition.

The committee of a person of unsound mind so found by inquisition may discharge the patient by an order under his hand accompanied by an office copy of the order appointing him committee.

By sec. 49 of the Lunacy Act, 1890, any person may apply to the Board of Control for a mental patient in an institution or in single care, to be examined by two medical practitioners ; and if they certify that the patient may be discharged without risk of injury to himself or the public, the Board may order his discharge.

It would seem that only a Secretary of State has power to release a criminal lunatic.

In forming an opinion as to the propriety of discharging a person who has once been confined as a patient in a mental institution, the particulars of his case should be examined with the same caution as if the object were to confine him for the first time. It may also happen that an individual has a lucid interval at the time of examination, in which case it will be necessary to make more than one visit. One who has been guilty of a heinous crime like murder, should never on any pretence be discharged. There are often long lucid intervals in insanity in a form in which homicide has been attempted, and it is impossible to be certain that the disease is entirely removed. The case of a clergyman named Watson, who shot at the Master of the Rolls, is a case in point. He made repeated applications to be liberated from the Broadmoor Criminal Lunatic Asylum on the alleged ground that he was quite sane ; but the Home Secretary refused to accede to this. At length he made a murderous attack upon the medical superintendent of the asylum. If the person has manifested the least **disposition to suicide**, great caution should be exercised in liberating him. The propriety of granting liberation cannot always be tested by the lightness of the offence for which a criminal lunatic [1] has been ordered to be detained. The circumstances in which the most trifling offence has been committed may show that the mind is wholly unsettled so far as regards moral responsibility, and such mental patients can never be trusted, even when there is a great amelioration in their language and deportment. The unhappy result of prematurely discharging a criminal lunatic [1] was seen in the case of a man named Thom, who called himself " Sir William Courtenay," and was shot during a riot near Canterbury. The whole life of this man consisted in a combination of eccentricity and insanity. He was found guilty of the most flagrant perjury, and having been found insane, was ordered to be detained as a criminal lunatic. After six months he appeared to be so much improved as to allow of his discharge, although even at this time he imagined himself to be the Saviour. After his discharge he committed many extravagant acts. He collected a number of ignorant persons as his followers, and infected them with his delusions. He resisted the soldiers who were sent to arrest him, and eleven lives were lost before he was overcome.

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[1] This term has been retained by the Mental Treatment Act, 1930.

A patient in a mental hospital suffered from a delusion respecting the fidelity of his wife. At the expiration of eight or nine months, he appeared to be much improved in bodily and mental health, and the delusion appeared to be less marked. Eventually he cunningly declared that his mind was quite at ease respecting his wife, and that he no longer believed that she had or could have been unfaithful to him. Under a mistaken impression that he had quite recovered, the patient was discharged and permitted to return home. For several days after joining his family he appeared quite well. A week or ten days after his return he murdered his wife and child in the belief that the former had committed adultery, and that the child was not his own.[1]

A medical man cannot always be responsible for unfortunate consequences of this kind : but these and other similar instances show that great risk is incurred in hastily allowing the discharge of a mental patient who has once been guilty of a crime.

As a general rule it is never safe to allow a certified patient who has recovered to return *to the circumstances in which his conduct was such as to necessitate certification*, whether these be the circumstances relating to business strain, or mental worry, or even simple domestic relations.

The Mental Deficiency Acts, 1913 to 1938

We have already quoted sect. 1 of the Act of 1913 (as amended by the Act of 1927) with its definitions (*vide* p. 631).

Sect. 3. Two medical certificates are necessary in placing a defective under control in a certified institution or house when a parent or guardian takes action.

Sect. 5. A petition presented to a judicial authority by a relative or friend or the parent or guardian also requires two medical certificates or a certificate that a medical examination was impracticable.

Sect. 8. Where it appears to a court of summary jurisdiction that a person convicted of or charged with an offence is a defective, the court may order him to be detained in an institution for defectives or be placed under guardianship.

Sect. 9. Where the Secretary of State is satisfied from the certificate of two duly qualified medical practitioners that any person who is undergoing imprisonment (except under civil process) or penal servitude . . . is a defective, he may order his transfer to an institution for defectives.

Sect. 11. An order sending a defective to an institution or placing him under guardianship shall remain in force for a year after the date of expiry thereof, and thereafter for successive periods of five years, if at that date and at the end of each period of one and five years respectively the Board of Control, after considering the special reports and certificate mentioned in the Acts of 1913 to 1938, and the report of a medical practitioner who has made a medical examination of the defective, consider that the continuance of the order is desirable.

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[1] Winslow : "Obscure Dis. of the Brain," p. 215.

Sect. 16. In respect of a mental defective detained in an institution the consent of the Board of Control is necessary before steps are taken to remove him to a mental hospital.

These Acts are not of much medico-legal interest, unless a medical man be placed in charge of a defective or of a licensed institution for defectives ; but in this event he will need to study the Acts very carefully.

Responsibility of the Insane

This may be divided into civil and criminal responsibility. Inasmuch as the law presumes that every man is sane until he is proved insane, there is no subject in legal medicine which has given rise to greater controversy than the fixing of the degree and form of insanity which shall free a person from a contract into which he has entered, or from the consequences of a wrongful act which he has committed.

In *R.* v. *True*,[1] the late Mr. Justice McCardie said that the law of England as a whole was complex with regard to insanity. " As to crimes, contracts, wills, detention in asylums, and other matters, about eight different tests are applied to it."

Judging by recent decisions of the courts, it would seem that the question of the *civil* responsibility of the insane is as far from being settled satisfactorily as it has ever been ; so far as regards *criminal* responsibility, however, a dictum exists, and is dealt with below.

The subject of responsibility will be considered in the following order :—(i) Competency of a person of unsound mind as a witness ; (ii) Insanity and marriage ; (iii) Insanity and contracts ; (iv) Insanity and torts ; (v) Testamentary capacity ; (vi) Criminal responsibility.

(i) Competency as a Witness

A question of some importance has from time to time arisen in regard to the admissibility of the evidence of a person of unsound mind concerning facts alleged to have been witnessed by him.

The degrees of insanity are infinite : some persons of unsound mind are as fully competent as sane persons to observe and to remember facts, and to understand the obligations of an oath ; it follows, therefore, that incompetency to give testimony must not be inferred from a mere name assigned to the malady from which a person is suffering ; but it must be decided by the special condition of the patient. Under any other view, crimes of the greatest enormity might be perpetrated in mental institutions without the possibility of convicting the offenders. The fact of incompetence to testify is not necessarily connected with a state of insanity ; and it would be far more correct to regard it as an independent fact to be established by a distinct method of proof. The truth is, an analogy in a medico-legal sense has been assumed too hastily between giving evidence and performing business contracts and other civil acts ; and, in consequence, the former has been placed with the latter in the same sentence of disqualification without an attempt to ascertain the kind and degree of intellectual power which these acts respectively require.

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[1] *Infra.*

In *R.* v. *Hill*[1] the evidence of a man named Donnelly was tendered on the part of the Crown. This man was a rate-aided person of unsound mind, and as such was confined in the same ward as the deceased, who, it was alleged, had been maltreated and killed by the prisoner. It was quite clear from the examination of Donnelly at the trial that he laboured under insane delusions that he was constantly visited by spirits, etc.; nevertheless, he gave a clear and consistent account of the manner in which the deceased was maltreated by the prisoner; and although he expressed his firm belief in the existence of spirits and their secret power of communicating with him, he appeared to have a full knowledge of the difference between truth and falsehood. His evidence was received; and, upon this, the prisoner was convicted.

Subsequently the case was argued upon appeal before all the judges; and they decided in favour of the admissibility of the evidence. It may, therefore, be considered as settled that a person of unsound mind who suffers from delusions, but in the opinion of the judge, upon the evidence of a medical practitioner, is capable of giving an account of a transaction which happened before his eyes, and who appears to understand the obligation of an oath, may be called as a witness. Before he is sworn, the person of unsound mind may be cross-examined, and witnesses called to prove circumstances which tend to show that he is incompetent to give evidence; but, in the absence of such evidence, and upon such medical evidence as is indicated above, the person of unsound mind may be allowed to give evidence; and it must be left to the court to measure the value of his testimony.

(ii) Insanity, Marriage and Mental Deficiency

Marriage in English law is more than an ordinary contract, inasmuch as it involves a change of status.

Insanity is an impediment to marriage, because an insane person cannot give that rational consent which is necessary to the validity of a contract. The marriage of a person of unsound mind so found by legal inquisition is null and void to all intents and purposes whatsoever, even though it may have been celebrated during a lucid interval.[2] In the case of a person of unsound mind not so found by legal inquisition, the marriage will be invalidated where consent is wanting by reason of the incapacity of either of the parties of comprehending the nature and of fulfilling the physical conditions of the marriage contract.

By the Matrimonial Causes Act, 1937, a marriage may be declared null upon proof that either party to the marriage was at the time of the marriage a mental defective or subject to recurrent fits of insanity or epilepsy.

Weakness of intellect, as distinguished from certifiable insanity or mental deficiency at the date of the marriage, is not a sufficient ground for invalidating a marriage. (But see the Matrimonial Causes Act, 1937, Vol. II.)

Under the Matrimonial Causes Act, 1937, in England and Wales, and a corresponding act in Scotland, *supervening insanity* is now a ground for dissolution of marriage. Before the court can dissolve a marriage on this ground, it must be satisfied by medical evidence that the disease is incurable, and that the patient has been continuously under care and treatment for at least five years immediately preceding the presentation of the petition.

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[1] 20 L. J. M. C. 222.

[2] Marriage of Lunatics Act, 1811

In *Reed* v. *Legard* a question arose whether a person of unsound mind was responsible for necessaries supplied to his wife. The articles supplied were for the sole use of the wife, the husband being a person of unsound mind and a patient in a mental hospital. The court held that the fact that a husband was unable to manage his affairs did not absolve him from the obligation, which he contracted when he married, to provide necessaries for the support of his wife. When he married he was of sane mind ; and, although he had subsequently become insane, that obligation had not thereby ceased.

(iii) Responsibility in Ordinary Contracts

The validity of ordinary contracts entered into by persons of unsound mind will depend mainly on the circumstances which accompany the act. If there be nothing unreasonable in the conduct of the person of unsound mind, and the party with whom he contracts has no knowledge or suspicion of his insanity, then the contract will be binding on the person of unsound mind and his representatives.

In *Molton* v. *Camroux* [1] the administrator of a deceased person sued the secretary of an insurance office for a sum paid by the deceased as the consideration for two annuities, it being alleged that at the time when the agreement was made the deceased was not of sound mind. It appeared that the negotiations had been conducted by the deceased with apparent prudence, sanity, and judgment, although in fact the deceased (who died very soon after the business had been arranged), was insane both before and after the transaction.

In the above case it was laid down as a general rule, that when a person of apparently sound intellect enters into an ordinary contract, and the parties cannot be restored to their former condition, the mere fact that one of them was at the time *non compos mentis* is no ground for setting aside the contract.

Every person dealing with a person of unsound mind with knowledge of his incapacity is deemed to perpetrate upon him a fraud which avoids the contract.

Molton v. *Camroux* was followed in *The Imperial Loan Co.* v. *Stone* [2] where a promissory note had been signed by a person of unsound mind as surety. The defence was that the person sued was so insane when he signed the note, as to be incapable of understanding what he was doing, and that such insanity was known to the plaintiffs. The case was taken to the Court of Appeal. where it was held that the contracts of a person who is *non compos mentis* may be avoided when there is proof that his condition was known to the other party.

In *York Glass Co.* v. *Jubb*,[3] the Court of Appeal held that there is no right to avoid a contract made with a person of unsound mind unless it be proved that the other party either knew that he was of unsound mind or knew such facts about him that the other party must be taken to have been aware that he was of unsound mind.

It is significant that the Judicial Committee of the Privy Council upon at least two occasions since the decision in *The Imperial Loan Co.*

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[1] 4 Exch. 17.

[2] [1892] 1 Q. B. D. 599.

[3] (1925), 42 T. L. R. 1.

v. *Stone*, have refused to follow that decision. The two cases referred to are *Daily Telegraph Newspaper Co.* v. *McLaughlin*[1] and *Molyneux* v. *Natal Land and Colonisation Co.*[2]

Supervening insanity does not release a person from his obligations under a contract unless the nature of the insanity render the performance of the contract impossible.[3]

The general law of agency is not invalidated by the insanity orone of the parties; and in *Yonge* v. *Toynbee*[4] the Court of Appeal decided that an agency created during sanity will be determined *ipso facto* by the insanity of the principal or of the agent. So that where an authority given to an agent has, without his knowledge, been determined by the insanity of the principal, and, subsequently to such insanity the agent has, in the belief that he was acting on behalf of the principal, made a contract with a third person, the agent will be liable in respect of any damage which may be sustained by the third party by reason of the non-existence of the principal's authority.

The insanity of a partner does not *of itself* dissolve the partnership, unless the articles of partnership contain a provision to that effect; hence, unless steps be taken for dissolution, the insane partner continues to be entitled to share the profits and to be liable for the losses of the firm.

Where necessaries are supplied to a person of unsound mind, the law raises an implied obligation to pay a reasonable price therefor, provided that the necessaries supplied are suitable to the position in life of the person of unsound mind.[5]

A husband is liable for necessaries supplied to his wife during his insanity, inasmuch as the wife's authority to pledge her husband's credit for necessaries is not a mere agency, but springs from the relation of husband and wife, and is not revoked by the bare fact of the husband's insanity.[6]

(iv) Insanity and Torts

An examination of the leading English text-books on the law of torts shows that there is a remarkable absence of authority on the question whether a person of unsound mind is liable for his torts. In this connection Sir William Markby wrote[7]: "How far a person who is insane would be held responsible, in courts of civil procedure, for his acts or omissions independently of contract, is a matter on which one is surprised to find our law books nearly silent."

The most authoritative statement of the law of England upon this matter would appear to be that which was made by Lord Esher in *Hanbury* v. *Hanbury*,[8] where he said that he was "prepared to lay down as the law of England that whenever a person does an act which is either a criminal or a culpable act, which act, if done by a person with a perfect mind, would make him civilly or criminally responsible to the law, that was an act for which he could be civilly or criminally responsible to the law, *provided the disease of the mind of the person doing the act be not so great as to make him unable to understand the nature and consequence of the act which he was doing.*"

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[1] [1904] A. C. 776.
[2] [1905] A. C. 555.
[3] *Hall* v. *Warren*, 9 Ves. 605.
[4] [1910] 1 K. B. 215.
[5] *In re Rhodes*, 44 Ch. D. 94, and Sale of Goods Act, 1893.
[6] *Drew* v. *Nunn*, 4 Q. B. D. 661.
[7] "Elements of Law," p. 131.
[8] 8 T. L. R. 559.

It is beyond the scope of this work to discuss the matter further; those seeking additional information are referred to "Insanity in Relation to Legal Responsibility," Cook, 1921.

(v) Testamentary Capacity

This is discussed under the following heads :—

A disposing mind.
Aphasia and will-making.
Delusions and will-making.
Eccentricity and will-making.
Undue influence and will-making.
Suicide and will-making.
Wills *in extremis.*

A Disposing Mind. Questions involving the testamentary capacity of persons are of frequent occurrence, and medical evidence is usually called for. When a testator disposes of his estate in an abnormal manner, it may be alleged by the relatives that he was wholly incompetent to understand the nature of his act—either from insanity, the imbecility of age, or from that natural failing of the mind which often takes place as a result of disease or on the approach of death. The law requires a *disposing mind* in order to render a will valid. The practical test is: Did the testator, at the time of executing the will, know the nature and amount of his property and the just claims of those who had claims upon his bounty? It has been said truly that the evidence on this matter of the medical attendant who was present at the time of the execution of the will is of greater value than the opinions of experts or of witnesses who may have seen the testator at other times and in other circumstances. The capacity for making a will does not depend solely upon the testator's sanity or insanity, but rather upon the proof of competency or incompetency on the part of the testator at the time when he made the will.

A medical man is often asked to witness a will. He should remember that when he signs his name as a witness, he is regarded as testifying to the testator's competency to make a will.

Bodily disease or incapacity does not affect the validity of a will, unless the mind be directly or indirectly disturbed thereby.

In all cases of this kind the law looks exclusively to the actual *effect* of the bodily disease upon *conduct*; and this is a question for the determination of the court from the evidence of those who attended the deceased, as well as from the evidence of medical experts; but, so far as a "disposing mind" is concerned, judges look very much more to the actual distribution of the property than to anything else; and, so long as the terms of the will do not seem to inflict any substantial injustice upon any near relatives, it is probable that the will will be upheld.

An attempt to deal with the situation created by the moral incapacity of a testator is made by the Inheritance (Family Provision) Act, 1938, whereby a surviving spouse or other dependant of a testator or testatrix who dies domiciled in England or Wales, may apply to the Court for an order for reasonable provision to be made for his or her maintenance in cases where the deceased by his will has failed to make reasonable provision for the maintenance of the applicant. Many successful applications have been made under this statute.

Test of Capacity. The question of testamentary capacity is eminently a practical one, and it is one which does not depend solely on scientific or legal definition. In determining whether or not a testator at the time of making his will was possessed of testamentary capacity, the court takes account of the following considerations: There must be on the part of the testator a sound mind, as well as a memory which is able to recall the several persons who may be fitting objects of his bounty, and an understanding to comprehend the relationship of the beneficiaries to himself, and their respective claims upon him. By "sound mind" the law does not mean a perfectly balanced mind; because, if this were so, no one would be competent to make a will. The law makes considerable allowance for diversity of character; it disregards eccentricities of manner, of habits of life, of amusements, of dress, and so on. The general test is: Was the testator, *at the time of making the will*, labouring under a delusion of such a nature that he conceived something extravagant to exist which had no existence except in his own imagination, and that he was incapable of being—or at least of being permanently—reasoned out of that delusion? It is essential to the exercise of the power of making a will that the testator shall not be suffering from any disorder of the mind which would poison the affections, pervert his sense of right, or prevent the exercise of his natural faculties; that no insane delusion shall influence his mind in disposing of his property in such a way as would not have been done if the mind had been sound.[1]

As a general rule, the will of a person of unsound mind made during his insanity is void; but the will of a person of unsound mind, whether so found or not, made during a lucid interval is valid. A will executed during insanity does not become valid by the subsequent recovery of the patient.

There is, however, a difference between unsoundness of mind indicated by unfitness to manage one's own affairs and that defect of mind which deprives a man of the power of disposing of his property by will. A mind may be clear enough for the performance of some functions, and yet be not clear enough for the performance of others. A man may give clear and reasonable directions for the preparation of a will, and even sign it in a natural manner, but he may be governed by caprice and passion amounting to insanity *ad rem.*, *i.e.*, in the disposition of his property. It has been well remarked that "so long as human nature is the mysterious phenomenon that it is, and the empires of reason and unreason border so closely on each other, we must expect often to err when we try to discover whether a man, alternately the subject of both, was in or out of his mind at any given moment." A disposing power may exist in the mind of a person not legally competent to manage his own affairs. The criteria applied are different, and the existence thereof must be proved in each particular case.

Where the validity of a will is contested on the ground of incapacity, the issue is not whether the testator could have made a will, but whether he had capacity to make the particular will in dispute; and in order to form a proper judgment on this matter, a medical expert intended to be called as a witness should read the instrument before he gives an opinion.

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[1] *Banks* v. *Goodfellow*, 5 Q. B. 549.

Aphasia and Will-making. In connexion with wills and the medico-legal questions arising therewith, a rough diagram of the parts of the brain and sense organs concerned in the process has been inserted, together with a very brief sketch of the physiology of the matter. For details, with experiments, etc., the reader is referred to works on cerebral localisation.

Where the will is written by the testator in his own handwriting (holograph wills), the only points to be considered are :—

(1) Is the document written in such a manner as to be legible and capable of true construction ?

(2) Does it clearly express the wishes of the testator ?

(3) Was the testator suffering from any delusion regarding any possible beneficiary or other persons and things which caused him to make a will other than that which he would otherwise have made ?

Questions of agraphia and aphasia can hardly arise, for the mere existence of the document in legible script will *ipso facto* prove the absence of the former, and the latter is immaterial in writing, except in so far as the general terms of the will may seem to show the more complicated effects of the presence of sensory aphasia and lack or disturbance of memory, delusions, etc.

Where the will is more or less formally written by others and submitted to the testator to read and to sign, or is read over to him before signature, difficulties may arise from "aphasia" in its widest and broadest sense.

Aphasia has for subdivisions aphemia, agraphia, word-blindness, word-deafness, etc., the explanation of which may be seen by a glance at the diagram (see next page) which may be explained thus :—

External stimuli of every possible nature and variety must fall upon terminal sensory organs, skin, ear (B in figure), eye (A in figure), etc., before they can be appreciated; in such terminal organ they excite a process in the nervous apparatus there provided, which process is

(*a*) carried to the cortex of the brain, and there excites in turn an impression that something has been seen or heard (percept); but such impression is

(*b*) appreciated by the mind, becomes a concept, *i.e.*, the meaning of the external object or word is recognised, in some (evolutionary) higher centre of the brain.

This higher centre sends messages down to the motor (speech or writing) centres, which messages are translated into speech or writing by the terminal organs executing the movements of speech or writing.

Obviously there are myriads of other percepts and concepts with which we are only concerned in our present considerations in so far as by disarrangement they cause delusions and hallucinations, etc., constituting "insanity" in general.

These false concepts may quite possibly be confined strictly to other subjects than those concerned in the will, and it is our business to estimate in any given case whether the concepts in connexion with the will are true or false, and whether the outward expression in speech or writing corresponds with true concepts. The court requires unbiased and convincing evidence that the will represents intentions which are obviously only the expression of true concepts: this is the physiological meaning of a disposing mind.

Inasmuch as concepts of objects form "a disposing mind," lesions of C itself are the most important obstacles to will-making, for if only A *or* B be cut off from C, we can still reach C by the alternative route. Neither deafness nor blindness, nor a combination of both, prevents a testator from possessing a disposing mind.

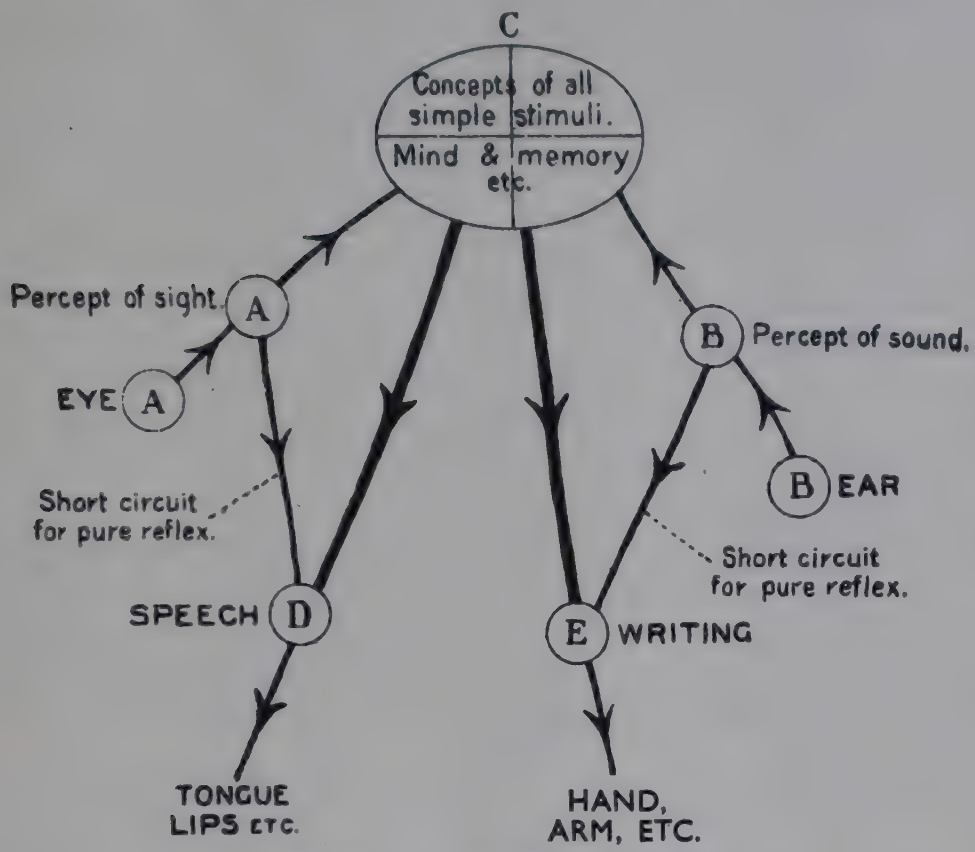

Fig. 48. Explanation of Letters.

A′ and B′ are parts of the cerebral cortex, probably in occipital lobe; C is certainly situated in the temporo-sphenoidal lobe, so far as sight and hearing are concerned; D in Broca's convolution; E in the ascending frontal convolution.

Lesion of A and A′ or between A and A′ = blindness }
Lesion of B and B′ or between B and B′ = deafness } in their ordinary meanings.
Lesion of C or between A′ (or B′) and C = word-blindness (or word-deafness), *i.e.*, word is heard or object seen but not appreciated; no concept of it.
Lesions between C and D or E constitute motor aphasia or agraphia.

Lesions between C and D *or* E may in like manner be overcome by alternative routes, but if the testator can neither speak nor write, other means (such as the following example) must be found for ascertaining the testator's intentions.

A man suffering from disease affecting the brain was unable to write, and only with difficulty could be made to understand what was said; but evidently he wished to make a will. He could read and could understand what was written. The medical man in attendance caused the names of possible legatees to be written, each on a separate card, and the articles of property also each on a separate card; the patient was then able to put a name and a piece of property together by means of these cards. Probate in the sense of these terms was granted.

Delusions and Will-making. A dispute often arises to the validity of a will executed by a person suffering from delusions. The mere existence of a delusion in the mind of a person does not of itself necessarily vitiate a will, unless the delusion forms the groundwork of such will, or unless conclusive evidence be given that, at the time of executing the will, the testator's mind was influenced by the delusion in making the will.[1]

Although a will may be manifestly unjust to the surviving relatives of a testator, and it may indicate that the testator held extraordinary views, it will not necessarily be void unless the testamentary dispositions clearly indicate that the testator's mind was affected by his *delusions.*

Delusions may co-exist with testamentary capacity: so that, if the testator comprehends the extent of the property to be disposed of, and the nature of the claims of those whom he excludes, partial insanity, not affecting the general faculties and operating in regard to testamentary disposition, is insufficient to render him incapable of making a will.[2]

Eccentricity and Will-making. Whereas the will of an eccentric man would probably be such a will as might have been expected from him, the will of a person who is suffering from delusions is different from that which he would probably have made if he had been normal, that is to say, in the latter case, the instrument is entirely different from what it would normally have been. The insane are eccentric either in their ideas, in their language, or in their conduct; but persons who are merely eccentric have only a voluntary resemblance to the insane. They are able, at their pleasure, to alter their conduct and to act like normal persons. It seems impossible to define precisely the distinction between eccentricity and insanity, or to draw the exact line between sanity and insanity; but for practical purposes it is possible to determine in a particular instance whether a man is sane or insane or only eccentric.

The will of a medical electrician was disputed by his daughter on the ground of insanity. The testator believed that he could deliver pregnant women by means of electricity; and he actually proposed to the wife of a baker living in the neighbourhood, to bring about her accouchement by a number of wires connected with an electrical machine. The will was pronounced invalid, not so much on account of this absurdity, as of the violent and unnatural treatment to which he had subjected his daughter. It appeared that he had taken, as persons of unsound mind sometimes do, a most unaccountable dislike to her from birth.

Mere eccentricity must be distinguished from insanity. In *Frere* v. *Peacock*[3] it was held that moral insanity, or a moral perversion of the feelings, unaccompanied by delusions, is insufficient to invalidate a will; eccentricity on the part of the testator does not amount to insanity.

Sane childless women who live solitary or secluded lives are often very fond of animals. One old lady used to keep her sitting-room full of monkeys, to the great annoyance of her visitors. She was a woman of good family, and of a shrewd and strong mind, well able to look after her affairs and to dispose of her property. She was considered to be eccentric, but there was no indication of insanity. Other women are not happy unless surrounded by parrots, or unless their sitting-rooms are converted into aviaries for all kinds of birds. In one case, a woman whose sanity was disputed, was very fond of cats, for which she provided meals at regular hours, complete with plates and napkins. In that case insanity was established, not so much on the ground of the special attention which she had given to the cats, as from her acts in regard to her property, and from the history of her association with certain persons who took advantage of her mental weakness. Abnormal fondness of animals does not prove the existence of insanity unless there is at the same time evidence of mental aberration.

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[1] *Banks* v. *Goodfellow*, L. R. 5 Q. B. 549.

[2] *Pilkington* v. *Gray*, [1889] A. C. 401.

[3] 1 Rob. 442.

In *Boughton* v. *Knight*,[1] the will was contested by the sons of the testator on the ground of mental incapacity. The testator was a reserved man and shunned society. He had lived alone for some years; and was peculiar and eccentric in his habits. He was fond of listening to German bands, and of seeing his servants dance; he fed rats and shot rooks in company with a female servant. He was of a capricious and suspicious disposition; he had a delusion that he had perpetrated crimes, and that people were watching him. On the other hand, he had managed his own affairs without any suggestion that he was insane, and his correspondence showed that he was rational and had complete capacity for conducting business.

Although the testator had capacity to manage his property, it was held that he had not sufficient capacity to dispose of it by will. The court held that a man moved by capricious, frivolous, mean, or even bad motives, may disinherit his children, and leave his property to strangers: he may take an unduly harsh view of the character and conduct of his children; but the law places a limit beyond which such action will cease to be regarded as a matter merely of harsh, unreasonable judgment, and beyond which the revulsion which a parent exhibits towards his own child will be concluded to proceed from some mental defect.

From the judgment delivered in *Smith* v. *Tebbitt* [2] it appears that the question of insanity is a mixed one, partly within the range of common observation and partly within the range of special experience; and it is the duty of the court to inform itself of the general results of medical observation. A medical expert may give an opinion whether the acts of an eccentric testator are evidence of delusions. He may also be able to say, from a consideration of the previous habits and manner of life of the testator, whether at or before the making of the will there has been any change of habits or character which would indicate insanity—*e.g.*, the existence of an unaccountable hatred of members of the family who are not mentioned in the will, and a suspicion and distrust of all around him. Cruelty to children, unnatural conduct towards a wife, and the keeping and feeding of animals as pets, are matters which can be considered in relation to testamentary capacity as well by a learned judge as by experts in insanity.

Undue Influence in Will-making. "Undue influence" is frequently alleged as a ground for having a will set aside. The exercise of undue influence by one person over a testator, in order to procure a will in favour of himself or of some third person, renders the will invalid. What amounts to undue influence depends upon the circumstances of each particular case.

In order to set aside a will on this ground, it must be shown that the circumstances in which the will was executed are inconsistent with any hypothesis other than of undue influence. The exercise of undue influence must be proved to have been exercised in relation to the will itself, and not merely to other transactions.[3]

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[1] 3 P. & M. 64.

[2] 1 P. & D. 398.

[3] *Boyse* v. *Rossborough*, 6 H. L. C. 2.

"Undue influence" is possible as a rule only when the testator is below the average mentally; for example, when he is suffering from incipient dementia, such as often accompanies old age. In such cases, however, it frequently happens that someone (daughter, second wife, niece, or stranger) takes special care in looking after the testator, and when the devoted nurse benefits under the will, disappointed relatives sometimes raise the question of undue influence. In these cases, if a medical man is present when a will is executed, he may easily satisfy himself as to the state of mind of a testator, by requiring him to state from memory the manner in which he has disposed of the bulk of his property.

A person may resort to honest intercession and persuasion quite properly in order to procure a will in favour of himself; but persuasion brought to bear upon a testator who is on his deathbed, or in a weak state of health, may be equivalent to force inspiring fear, *e.g.*, if such persuasion amounts to importunity which the testator is too weak to resist, and which renders the making of the will no longer the offspring of his own volition.[1]

If a medical man be disinterested, he may be of great service in the case of a disputed will; but when a medical man takes a direct benefit under the will, the court will inquire very closely into all the circumstances connected with the drawing up and execution of the will. The court may set aside such a will on the ground of undue influence, inasmuch as the position of a medical attendant is very similar to that of a trusted friend, nurse or adviser.

If a medical man expects to benefit under the will of a patient with whom he is on familiar terms, he should take the greatest care to secure the intervention of a professional lawyer, with a view to placing his own position above suspicion.

If a beneficiary under a will, or his or her spouse, signs his or her name as a witness to the will, the gift to such beneficiary will be void.[2]

Suicide and Will-making. The act of suicide is sometimes assumed to be evidence of insanity; but it is not accepted as conclusive proof of insanity, even where the testator took his life shortly after the execution of his will. A testator committed suicide three days after having given instructions for his will; but, in the absence of other evidence of insanity, the will was pronounced valid. In *Edwards* v. *Edwards*, the testator committed suicide three days after the execution of his will, and there was some evidence of eccentric habits almost amounting to insanity; the will was pronounced to be valid. Suicide *per se* is not deemed in law to be a proof of insanity (*vide* "Suicide").

Wills in Extremis. Where a person whose mental capacity during life has never been doubted makes a will while lying at the point of death (*in extremis*), such will may be regarded with suspicion; and may be set aside if there is medical evidence that the testator had not a disposing mind at the time of the execution of the will. Many diseases, particularly those which affect the brain or nervous system directly or indirectly, produce a dullness or confusion of intellect which may deprive the patient of his testamentary capacity.

[1] *Wingrove* v. *Wingrove*, 11 P. D. 81

[2] Wills Act, 1837, s. 15.

A will was set aside because it was executed by the testatrix while she was suffering from an attack of cholera, and proper means had not been taken to test her capacity. At the time of the execution of the will, the testatrix was reduced to such an extreme state of weakness that her mental powers were impaired. The validity of another will was contested on the ground that the testator was at the time of execution suffering from gastric fever. The will was witnessed by the medical attendant and by the solicitor, both of whom deposed to the competency of the testator, *i.e.*, that the disease had not reached that point where the brain was affected or the mind disturbed. In all cases of this nature *integritas mentis non corporis sanitas exigenda est.*

A will executed by a dying person during delirium would be pronounced invalid. On the other hand, on some occasions, when the mind has been weakened by disease or infirmity from age, it has suddenly cleared up before death; and the person has unexpectedly shown a disposing capacity.

Where a testator made his will when on his deathbed, his medical attendant took his instructions, and shortly afterwards a solicitor drew the will in accordance therewith. The medical attendant and the solicitor attested the will, but it was alleged that, although he was conscious when instructions were given, the testator was unconscious when the will was executed. The solicitor thought that he was quite unconscious at the time of execution. The physician and the nurse thought that he was conscious.

The law requires not only that a man should be conscious at the time of execution of the will, but that he should have a sound and disposing mind. The party propounding the will is bound to establish this; and, where he fails to do so, the will must be declared invalid. It would appear from the evidence in the above case that the will was signed within *ten minutes* of the time at which the testator was known to have lost consciousness. His property was bequeathed to a stranger. At the time of executing the will the deceased said nothing, did nothing, and made no movement to indicate that he was aware of what he was doing.

A relative of the husband of a dying woman (who was aged 76) took instructions from her for her will which was drawn in his favour. The medical man gave evidence that the deceased had died from apoplexy, and that at the time of executing the will she was so exhausted by illness and by the near approach of death as to be incompetent. On the day of the execution of the will, the deceased retained in some measure her consciousness; it was very doubtful whether she had sufficient capacity to make a will. No other person was present when the instructions were given, and the husband's relative did not even take the precaution of reading the will over in the presence of the witnesses. Even if the deceased had full possession of her faculties at the time, there was some doubt whether she was fully aware of the contents of the will when she signed it. She was evidently in a state of great physical prostration at the time. The relative of the husband failed to satisfy the court that the deceased knew and approved the contents of the will, and the court therefore pronounced against it.

Whenever possible, care should be taken to make certain that the testator is able to state the provisions of the will, and to repeat them substantially from memory.

If the testator, at the time of giving instructions to a solicitor to prepare his will, is competent to make a will, the will will be valid although *at the time of execution* he may be too ill to understand the contents thereof, provided that he is conscious of having given the instructions and believes that the will has been prepared in accordance with them.[1]

Criminal Responsibility of the Insane

Responsibility signifies liability to punishment. A plea of insanity may be raised on any criminal charge, however trivial, but the plea is now seldom raised except on charges of murder, arson, theft, and crimes of gross immorality : in murder the plea is raised in order to avoid the death penalty, in arson, in order to avoid penal servitude, in theft in order to avoid imprisonment or the loss of social position, in sexual offences to avoid the stigma of real depravity.

A **criminal act** implies the existence of intention, will, and malice (Stephen).

Will is that mental power which can restrain intention and (or) malice from issuing in action.

In the insane, the will (the power of choice to do, or not to do a thing), is destroyed by mental disease.

Since it is illogical to *punish* a man for an act which is beyond his choice or control, the insane ought not to be punished for a crime.

Thus far, law and medicine are in complete agreement ; the differences between them arise in, and centre around the question of what is meant by insanity. A sort of compromise has been arrived at in that the rule of law now is that the insane are not treated for crime in precisely the same way as the sane ; with a view to protecting society, the sane are condemned to detention in prisons ; with a view to treating disease, the insane are placed either in mental hospitals, or in a criminal lunatic asylum, or their friends are ordered to take stricter care of them.

As along ago as 1843, an English judge said : " The defence of insanity has lately grown to a fearful height, and the security of the public requires that it should be closely watched " ; and in December, 1922, the Lord Chief Justice of England said, in the Court of Criminal Appeal, that the defence of insanity was becoming an invariable makeweight in trials for murder.[2]

As to the **Procedure in Criminal Cases where Insanity is Present or Pleaded,** there are six stages at which an accused person may be officially recognised as insane : (i) While awaiting trial ; (ii) upon arraignment ; (iii) when found guilty of the act, but insane at the time it was committed ; (iv) while awaiting judgment ; (v) when reprieved on the ground of insanity ; (vi) while undergoing imprisonment.

Legal Considerations and McNaghten's Case. Singularly enough, in no single instance has the Court for Crown Cases Reserved, the Court of Criminal Appeal, or any other court sitting *in banco*, delivered a considered written judgment on the relation of insanity to criminal responsibility ; although there are several such decisions as to the effect of insanity on the validity of contracts and wills (Stephen). Moreover, every judgment delivered during the last hundred years has been founded upon the answers given by fourteen of the fifteen judges consulted by the House of Lords, in consequence of the acquittal of McNaghten on the ground of insanity in 1843. The questions and answers are as follows :—

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[1] *Thomas* v *Jones*, [1928] P. 162, at p. 163.

[2] For an exhaustive discussion of the whole matter, the reader is referred to monographs on insanity and crime, *e.g.*, Savage's " Insanity," Mercier's " Criminal Responsibility," or to Stephen's " History of the Criminal Law of England," vol. 3. A very interesting paper was read by Mercier before the Med.-Leg. Soc. (*vide* Trans., 1908-9).

Question I.—" What is the law respecting alleged crimes committed by persons afflicted with insane **delusions in respect of one or more particular subjects or persons,** as, for instance, where, at the time of the commission of the alleged crime, the accused knew he was acting contrary to law, but did the act complained of, with a view, under the influence of insane delusion, of redressing or revenging some supposed grievance or injury, or of producing some supposed public benefit ? "

Answer I.—" Assuming that your lordships' inquiries are confined to those persons who labour under such partial delusions only, and are not in other respects insane, we are of opinion that (notwithstanding the accused did the act complained of with a view, under the influence of insane delusion, of redressing or revenging some supposed grievance or injury, or of producing some public benefit), he is nevertheless punishable, according to the nature of the crime committed, if he knew at the time of committing such crime that he was acting contrary to law, by which expression we understand your lordships to mean the law of the land."

Question II.—" What are the proper questions to be submitted to the jury when a person, alleged to be afflicted with insane delusions respecting one or more particular subjects or persons, is charged with the commission of a crime (murder, for example) and insanity is set up as a defence ? "

Question III.—" In what terms ought the question to be left to the jury as to the prisoner's state of mind at the time when the act was committed ? "

Answers II and III.—" As these two questions appear to us to be more conveniently answered together, we submit our opinion to be that the jury ought to be told in all cases that **every man is presumed to be sane, and to possess a sufficient degree of reason to be responsible for his crimes, until the contrary be proved to their satisfaction : that to establish a defence on the ground of insanity, it must be clearly proved that, at the time of committing the act, the accused was labouring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing, or, if he did know it, that he did not know that he was doing what was wrong.** The mode of putting the latter part of the question to the jury on these occasions has generally been, whether the accused at the time of doing the act knew the *difference between* right and wrong ; which mode, though rarely, if ever, leading to any mistake with the jury, is not, we conceive, so accurate when put generally and in the abstract, as when put with reference to the party's knowledge of right and wrong in respect to the very act with which he is charged. If the question were to be put as to the knowledge of the accused, solely and exclusively with reference to the law of the land, it might tend to confound the jury by inducing them to believe that an actual knowledge of the law was essential in order to lead to a conviction ; whereas the law is administered on the principle that everyone must be taken conclusively to know it without proof that he does know it. If the accused was conscious that the act was one which he ought not to do, and if that act was at the same time contrary to the law of the land, he is punishable. The usual course, therefore, has been to leave the question to the jury, whether the accused had a sufficient degree of reason to know that he was doing an act that was wrong ; and this course we think is correct, accompanied with such observations and corrections as the circumstances of each particular case may require."

Question IV.—" If a person under an insane delusion as to existing facts commits an offence in consequence thereof, is he thereby excused ? "

Answer IV.—" The answer must of course depend upon the nature of the delusion ; but, making the same assumption as we did before, namely, that he labours under such partial delusion only, and is not in other respects insane, we think he must be considered in the same situation as to responsibility as if the facts with respect to which the delusions exist were real. For example, if, under the influence of his delusion, he supposes another man to be in the act of attempting to take away his life, and he kills that man, as he supposes, in self-defence, he would be exempt from punishment. If his delusion was that the deceased had inflicted a serious injury to his character and fortune, and he killed him in revenge for such supposed injury, he would be liable to punishment."

Question V.—"Can a medical man, conversant with the disease of insanity, who never saw the prisoner previously to the trial, but who was present during the whole trial and the examination of all the witnesses, be asked his opinion as to the state of the prisoner's mind at the time of the commission of the alleged crime, or his opinion whether the prisoner was conscious at the time of doing the act that he was acting contrary to law, or whether he was labouring under any, and what, delusions at the time?"

Answer V.—"We think that the medical man, in the circumstances supposed, cannot in strictness be asked his opinion in the terms above stated, because each of those questions involves the determination of the truth of the facts deposed to, which it is for the jury to decide, and the questions are not mere questions upon a matter of science, in which case such evidence is admissible. But where the facts are admitted, or not disputed, and the question becomes substantially one of science only, it may be convenient to allow the question to be put in the general form, although the same cannot be insisted on as a matter of right."

According to the Lord Chief Justice of England, the law does not purport or presume to define insanity: that is a medical question. What the law considers is the conditions which have to be satisfied in order that a person may be excused from criminal responsibility—that is a legal question.[1]

The interpretation which has been placed by judges on the above-mentioned rule of law is illustrated in the three following cases, which were tried before the passing in 1907 of the Act which created the Court of Criminal Appeal:—

(i) In a trial in 1850 for shooting at Queen Victoria, the judge said that:—

> It was not because a man was insane that he was unpunishable; and upon this point there was generally a very grievous delusion in the minds of medical men. The only insanity which legally excused a man for his acts was that species of delusion which conduced and drove him to commit the act alleged against him. They ought to have proof of a formed disease of the mind, a disease existing before the act was committed, and which made the person accused incapable of knowing at the time he did the act that it was a wrong act for him to do.

The prisoner was convicted.

(ii) In *R.* v. *Burton* the judge said that:—

> Even the existence of mental disease did not necessarily exempt a person from criminal responsibility. Many a man whose mind is in an unsound state knows perfectly well whether he is doing wrong; and so long as he knows *that*, he is subject to the criminal law. Even morbid delusions cannot always be allowed to screen a criminal from the consequences of his own acts, while there are instances in which a plea of insanity may properly be allowed, although no such delusion can be proved. Each case must be taken with its circumstances, and legal theories of insanity are chiefly valuable, not as rigorous axioms of law, but as cautions to be observed by the jury.

The prisoner was convicted and executed.

(iii) In *R.* v. *Townley*, the prisoner committed a very atrocious crime in which the defence of insanity was raised. In regard to this defence, the judge said:—

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[1] See article on "The Criminal Law and Insanity" in "Essays and Observations" by Lord Hewart of Bury (1930).

"If the prisoner knew that the act he was committing would probably cause death, and that the doing of it would subject him to legal punishment, there was criminal responsibility. That was murder subject only to the question of insanity. No one could doubt that the prisoner knew what he was doing, and that his act would cause death. Unless he was insane, therefore, under such circumstances he was guilty of murder. No word was more vague than 'insanity.' Probably there was not one of the jury but was acquainted with some man who was in the habit of doing extraordinary things, and of whom people said, 'Why, that man must be insane.' *What the law meant by an insane man was a man who acted under a delusion, and supposed a state of things to exist which did not exist, and acted thereupon.* A man who did so was under a delusion, and a person so labouring was insane. In one species of insanity the patient lost his mind altogether, and had nothing but instinct left; such a person would destroy his fellow-creatures, as a tiger would his prey, by instinct only. A man in this state had no mind at all, and therefore was not criminally responsible. The law, however, went farther than that. If a man labouring under a delusion did something of which he did not know the real character, something of the effect and consequences of which he was ignorant, he was not responsible. The result was, that if the jury believed that at the time the act was committed the prisoner was labouring under a delusion, and believed that he was doing an act which was not wrong, or of which he did not know the consequences, he would be excused. If, on the other hand, he well knew that his act would take away life, that that act was contrary to the law of God and punishable by the law of the land, he was guilty of murder."

The jury returned a verdict of murder.

In the notorious case of *R.* v. *True*,[1] the prisoner was convicted of the murder by strangulation in brutal circumstances of a young prostitute, whom he had robbed of her jewellery. The plea of insanity, in the form of uncontrollable impulse, having been raised by the defence, the Lord Chief Justice said: "In the view of this court there is no foundation for the suggestion that the rule derived from *McNaghten's* case has been in any sense relaxed." The Court of Criminal Appeal held that the jury were entitled to say that the facts of the case, taken as a whole, satisfied them that at the time of committing the act the prisoner was not insane. The appeal having been dismissed, the sentence of death stood; but the prisoner was reprieved by the Crown and ordered to be detained during His Majesty's pleasure.

Though it appears still possible in theory for an insane person to be held criminally responsible, it is probably true to say that no insane person will nowadays be considered criminally responsible for murder to the extent of having to pay the full legal penalty for that crime.

This is certainly the position in Scotland, for as long ago as 1863 it was laid down that "in a strictly legal sense, there is no insane criminal. Concede insanity, and the homicidal act is not criminal. The act of the insane, which in the sane would be criminal, lacks every element of crime" (Lord Justice Clerk Inglis). Consequently, there is no such verdict under Scots Law as "guilty but insane." Furthermore, in Scotland, at least in cases of serious crime, a defence of "diminished responsibility" is admissible, where it can be clearly shown that there exists "an aberration or weakness of mind," or "a state of mind bordering on, though not amounting to, insanity"—states which are met with, for example, in certain cases of epilepsy, or following head injuries. The effect of a successful plea of diminished responsibility is to reduce the quality of an act from murder to culpable homicide (i.e. the Scots equivalent of manslaughter). In England, no such doctrine has been formally accepted, although the Infanticide Act recognises just such a degree of diminished responsibility in the case of a mother who kills her child in certain circumstances (see "Infanticide")—and the effect of this recognition is similarly to reduce the quality of her act from murder to manslaughter.

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[1] (1922), 16 Cr App. Cas. 165.

The Lord Chancellor's Committee. As a sequel to *True's* case, the Lord Chancellor on July 10th, 1922, appointed a committee "to consider what changes, if any, are desirable in the existing law, practice and procedure relating to criminal trials in which the plea of insanity as a defence is raised, and whether any and, if so, what changes should be made in the existing law and practice in respect of cases falling within the provisions of sect. 2 (4) of the Criminal Lunatics Act, 1884."

The committee reported that the British Medical Association desired to retain the existing law with a modification as to lack of control; but the Medico-Psychological Association (whose views the committee could not accept) desired to "sweep away the present rules," and to substitute other specified questions for the jury. The Medico-Psychological Association recommended :—

(1) That the legal criteria of responsibility expressed in the rules in *McNaghten's* case should be abrogated, and the responsibility of a person should be left as a question of fact to be determined by the jury on the merits of the particular case;

(2) That in every trial in which the prisoner's mental condition is in issue the judge should direct the jury to answer the following questions: —

- (*a*) Did the prisoner commit the act alleged ?
- (*b*) If he did, was he at the time insane ?
- (*c*) If he was insane, has it nevertheless been proved to the satisfaction of the jury that his crime was unrelated to his mental disorder ?

The recommendations of the Lord Chancellor's committee (November 1st, 1923) were as follows :—

"1. It should be recognised that a person charged criminally with an offence is irresponsible for the act when the act is committed under an impulse which the prisoner is by mental disease in substance deprived of any power to resist.

"2. Save as above, the rules in *McNaghten's* case should be maintained.

"3. Where a person is found to be irresponsible on the ground of insanity, the verdict should be that the accused did the act (or made the omission) charged, but is not guilty on the ground that he was insane so as not to be responsible, according to law, at the time. The existing statutory provision in this respect should be amended.

"4. Until such amendment the verdict should always be taken and entered as guilty of the act charged, but insane so as not to be responsible, according to law, for his actions at the time.

"5. Accused persons should not be found on arraignment unfit to plead except on the evidence of at least two doctors, save in very clear cases.

"6. The present law as to appeal should not be altered; *i.e.*, there should be no appeal on the finding of insanity either on arraignment or after trial, and in the latter case either as to the act or omission charged or as to insanity.

"7. Provision should be made, under departmental regulations, for examination of an accused person by an expert medical adviser at the request of the prosecution, the defence, or the committing magistrate.

"8. Provision for a panel or panels of mental experts is unnecessary."

As to the Criminal Lunatics Act, 1884:—

"9. It is essential that the statutory power under sect. 2 (4) should be maintained.

"10. The procedure under the sub-section is satisfactory and does not require amendment.

"11. The discretion of the Secretary of State should be exercised as at present."

The committee reported that the Medico-Psychological Association gave no clue to what they regarded as the test of criminal responsibility.

The committee's recommendation that a modified recognition should be given to the doctrine of irresistible impulse was referred to twelve High Court judges, who were consulted in 1924 as to the propriety of legislation for giving effect to such recommendation. Ten out of the twelve judges advised against the proposed alteration of the criminal law. A bill (The Criminal Responsibility (Trials) Bill) embodying the recommendations of the committee was introduced into Parliament, but was afterwards withdrawn.[1]

The Medical Aspect of the Question. In some respects medical opinion has seemed for many years to have ranged itself on the side of the criminal; but this is due not so much to a desire to preserve the criminal from punishment as from a fundamentally different view in regard to the results obtained from punishment as contrasted with the results which might be obtained from a different form of treatment.

Stephen, J., points out the chief matters on which medical and legal writers differ respecting the plea of irresponsibility,[2] and this chapter should be perused by all medical men who have to deal with insane criminals. The following is an outline of the views therein expressed:—

> "The different legal authorities upon the subject have been right in holding that the mere existence of madness ought not to be an excuse for crime, unless it produces in fact one or the other of certain consequences." The English law of insanity is stated thus, the doubtful points being placed within square brackets:—"No act is crime if the person who does it is at the time when it is done prevented [either by defective mental power or] by any disease affecting the mind (*a*) From knowing the nature or quality of his act, or (*b*) From knowing the act is wrong, [or (*c*) From controlling his own conduct, unless the absence of the power of control has been produced by his own default]. But an act may be a crime although the mind of the person who does it is affected by disease, if such disease does not in fact produce upon his mind one or other of the effects above mentioned in reference to the act." Speaking of knowledge of right and wrong, he says:—"I think that anyone would fall within that description (inability to know the quality of his act) who was deprived, by disease affecting the mind, of the power of passing a rational judgment on the moral character of the act which

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[1] A report of the speech of Lord Hewart against the Bill will be found in his "Essays and observations," *op. cit.*, p. 225; see also "Irresistible Impulse," *infra*.

[2] "Hist. of Crim. Law of Engl.," vol. 3, ch. xvii.

he meant to do." And again :—" Knowledge and power are the constituent elements of all voluntary actions, and if either is seriously impaired, the other is disabled. It is as true that a man who cannot control himself does not know the nature of his acts as that a man who does not know the nature of his acts is incapable of self-control."

Some men repudiate the doctrine that an insane person is necessarily irresponsible, and therefore unpunishable. All who have had opportunity for studying insanity, know that, with comparatively few exceptions, insane persons are not only powerfully influenced, but are materially controlled, by the same motives which influence and control sane persons who have never been suspected of mental derangement. For example, lunatic prisoners, when guilty of assaulting a prison warder, will sometimes say, " You can't touch me ; I am a lunatic." [1]

The difference of opinion which exists between physicians and lawyers may be stated shortly thus :—Most lawyers maintain that no degree of insanity should exempt from punishment for crime, unless it has reached that point *that the accused is utterly unconscious of the difference between right and wrong at the time of* committing the alleged crime.[2] Physicians, on the other hand, affirm that this is not an adequate test of the existence of that degree of insanity which should exempt a man from punishment ; that those who are suffering from confirmed insanity may be fully conscious of the difference between right and wrong, and are quite able to appreciate the illegality as well as the consequences of their acts. Again, those who have patiently observed the insane for years, agree that the legal test of unconsciousness of right and wrong in the performance of acts would in reality apply only to persons who were suffering from delirium, from a furious paroxysm of mania, or from confirmed idiocy ; and that if the rule suggested by Warren, that a person, in order to be acquitted on the ground of insanity, should be first proved to be as "*unconscious* of his act *as a baby*," were strictly carried out, there is scarcely a patient in a mental hospital who killed a nurse who might not be executed for murder. Such a rule amounts to a *reductio ad absurdum* ; it would abolish all distinction between the sane and the insane, between the responsible and the irresponsible ; and it would consign to the same punishment the certified patient and the sane criminal. This species of *baby-unconsciousness of action* exists in idiots as well as in furious maniacs, but not in the majority of the insane ; and it may be safely asserted that, if this criterion be the true one, acquittals on the ground of insanity have involved a series of gross mistakes. The only irresponsible persons of unsound mind, according to Warren, are precisely those who would not even have reason enough to plead to an indictment. Thus, while the medical profession is condemned for adopting opinions which would lead to the acquittal of criminals, this legal writer recommended a rule which would certainly lead to the execution of the greater number of certified patients charged with acts of homicide.

Difference between Law and Medicine

Right and Wrong. There is apparently a very sharp line of distinction between lawyers and medical men in the meanings which they attach to the words " right " and " wrong " ; to the lawyer they mean nothing more or less than lawful or unlawful, permitted or forbidden (under certain penalties), by the law of the land in which the act or word is done or spoken. This meaning seems to be preferable to the extremely vague idea "whether the act conforms or not to some very varying standard of morals and conduct, evolved from a mixture of religious dogma with a nebulous doctrine known as sociology." Parliament, as the supreme power in the land, has crystallised for us, in the shape of laws, the great bulk of the principles of sociology; and it would be wise to accept these as the basis of conduct. The existence of a nation as a united body seems to depend upon the observance of laws which have been agreed to by a majority; otherwise, if each may do what seems good in his own eyes, stable government would ultimately become impossible.

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[1] Dr. John Campbell's " Thirty Years' Experiences of a Medical Officer," p. 92.

[2] But see the report of the Lord Chancellor's committee (November 1st, 1923), *supra*.

On this subject Mercier[1] expressed the medical view as follows:—"Some persons are so deeply and completely insane or idiotic that we are not warranted in punishing them for any offence they may commit. The majority of insane persons are sane in a considerable proportion of their conduct; and when in this part of their conduct they commit offences, they are rightly punishable. It is a question for the jury whether the insanity did or did not influence the conduct. Since the limits between the sane and the insane areas of conduct of insane persons are ill defined, no insane person should be punished with the same severity that would be awarded to a sane person for the same offence. The foregoing propositions apply to persons who are insane in the ordinary sense, that is to say, who, whether deluded or not, exhibit intellectual defect or disorder. All such persons will be as completely or partially exonerated from punishment as justice requires, if the test is satisfied that they did not know the nature and quality of the act, and that it was wrong, provided that this knowledge includes knowledge and appreciation of the circumstances in which the act was done, and provided also it is held in mind that knowledge is a matter of degree, and that a person may know his act is wrong without knowing how wrong it is. The test of ignorance will not suffice in cases of moral insanity and moral imbecility. . . . It can scarcely be contended that morally insane persons should be completely exonerated from punishment for offences done to satisfy morbid desire. It does not, however, appear just to punish them with full severity. Although they are not exonerable under the test of insanity at present in force, yet, when the facts are brought before the judge, the punishment is usually, in practice, mitigated. It seems desirable that the state of moral insanity should be recognised as a morbid state, and the practice made universal in such cases. The test of ignorance will not suffice to exonerate moral imbeciles from the penal consequences of their offences. Yet it is repugnant to the sense of justice to punish persons who, it is clear, are morbidly constituted, and on whom punishment has no deterrent effect. It seems desirable that the state of moral imbecility should be recognised as a morbid state, and that, when proved to exist, the subject of it should not be convicted as an ordinary criminal, but should be relegated to special treatment, directed to the removal of his disability."

It has been objected that the *legal test*[2] is insufficient for the purpose intended: it cannot, in a large majority of cases, enable a distinction to be made between the insane homicide and the sane criminal. Many *insane persons* have committed acts which they knew to be wrong, and of the criminality of which they were at the time fully conscious. They have been known to commit murder in order to receive the punishment of death ; and, therefore, they must have been conscious of the wrongfulness, or rather of the illegality, of the act which they were perpetrating, and must have known that they were committing an offence against the laws of man.

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[1] "Crimes and Criminals," 1918.

[2] *Vide McNaghten's* case *supra.*

The legal test of a knowledge of the nature of the crime, or of right and wrong, may result in inconsistent and even conflicting verdicts.

In *R.* v. *Westron* the prisoner was charged with the murder of Mr. Waugh. On some provocation, partly real and partly based on an exaggerated view of his rights, the prisoner shot the deceased in full view of the public. The only question therefore for the jury was the state of mind of the prisoner at the time of the act. He was ill-tempered and violent about trifles ; but he had an acute knowledge of business. His conduct at times was very strange and unreasonable. Several members of his family had been insane, and the prisoner himself three years previously had suffered from mental excitement, but it did not make restraint necessary. The medical witnesses declined to say that the prisoner was in such a state of mind as to be incapable of knowing that the act of killing a man was wrong. The jury were directed to decide whether the prisoner was proved to have been in such a state of mind, at the time the act was committed, that he did not know the nature and quality of the act, or the distinction between right and wrong.

Upon the evidence, the jury found the prisoner guilty of " wilful murder," but they recommended him to mercy on account of an alleged " predisposition to insanity." Inasmuch as this verdict was tantamount to " not guilty on the ground of insanity," sentence of death was simply recorded.

It would appear upon careful examination that there is not so much conflict between the views of medical men and those of lawyers as may upon a first view appear. The Lord Chancellor's committee in their report of November 1st, 1923, said that " *much of the criticism directed from the medical side was based upon a misapprehension. . . . When once it is appreciated that the question is a legal question, and that the present law is that a person of unsound mind may be criminally responsible, the criticism based upon a supposed clash between legal and medical conceptions of insanity disappears*."

In this connexion the late Professor Kenny wrote : " As to the accused knowledge of the wrongfulness of the act, the judges say : ' If the accused was conscious that *the act* was one which he ought not to do, and if that act was at the same time contrary to the law of the land, he is punishable.' Thus the test is the power of distinguishing between right and wrong, *not*, as was once supposed, in the abstract, but in regard to the *particular act* committed." [1]

As to the meaning to be given here to " ought not," it was decided in *R.* v. *Codere* [2] that the meaning is wrong " according to the ordinary standard adopted by reasonable men."

In *R.* v. *Pank*,[3] the insane prisoner was under the double delusion (i) that his sister-in-law wished to commit adultery, and (ii) that it was consequently his duty to kill her in retribution. The judge directed the jury thus : " He knew the nature and quality of his act, for he knew that he was shooting, and that this shooting would kill her. Did he know that it was 'wrong'? If he knew that his act would be wrong in ordinary circumstances, it is no defence that he thought that the special circumstances present in this particular case would render it justifiable in him to do that act." He was convicted and executed.

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[1] Kenny, " Outlines of Criminal Law," 1943.
[2] 12 Cr. App. R. at p. 27.
[3] C. C. C., May 19th, 1919.

Schizophrenia. In *R.* v. *Phillips*[1] a theological student, aged 21, murdered and mutilated a manservant at his college. Upon medical evidence that he was suffering from schizophrenia, he was found guilty but insane.

Sadism. The Court of Criminal Appeal has held that sadism is not a form of insanity so as to justify a verdict of "guilty but insane." [2]

Matters which are of Assistance in deciding as to the Sanity or Insanity of a Criminal

An erroneous notion prevails that a "homicidal lunatic" is easily to be distinguished from a sane criminal by some *certain* and invariable symptoms or features. But a perusal of the evidence given at a few trials will show that each case must stand by itself. It may be said that in one case the murderous act was committed from a motive—*e.g.*, of revenge; in a second from no motive, but from irresistible impulse; in a third from illusion or delusive motive—*i.e.*, mental delusion; in a fourth from perverted moral feeling without any sign of mental aberration. This classification probably comprises all the varieties of homicidal insanity, but it does not assist in ascertaining in a doubtful case, whether the act was or was not committed by a person suffering from any of these psychological conditions.

There are three sources from which evidence of the insanity of an accused person may be obtained, *viz.* :—

1. His family history.
2. His personal history at the time of and prior to the offence.
3. The surroundings of the offence itself.

1. **Family History.** There is no doubt that a predisposition to insanity is frequently transmitted from parent to child through many generations. The disease may not always be manifested, because the offspring may pass through life without being exposed to any exciting cause; but as a rule, it readily supervenes from very slight causes. This hereditary taint is the most common of all the causes to which insanity can be referred.

Savage [3] said: "I believe that in fully one-third of all the cases of ordinary insanity, a history of insanity is to be detected in the family." In mental hospitals, records of the family history are carefully kept, and seem to bear out Savage's statements. It must not be understood, however, that the forms of insanity "breed true" as a matter of course, Thus, epileptic parents may have one child an epileptic, one an imbecile; another daughter may fail in her puerperium and so on; in other words, insanity in its widest aspect means "brain inadequacy for its environment," and this inadequacy may show itself in any one of the recognised forms, from mere eccentricity to imbecility or mania.

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[1] B.M.J. (1938), I. 1031.

[2] *R* v. *Hill*, 88, Sol. J., 134.

[3] Allbutt, *loc. cit.*

In some trials there has been a tendency to rely upon hereditary predisposition as almost the sole proof of insanity in an accused person. In *R.* v. *Christiana Edmunds*, where the prisoner was convicted of poisoning on an extensive scale, no evidence of insanity or of homicidal impulse could be found. There was a motive, an endeavour to fix the crime upon others, great skill in its perpetration, concealment with a full knowledge of the consequences of the act and of the punishment attached to it, and an endeavour to avoid this punishment by a false plea of pregnancy. In short, the conduct of the woman throughout was that of a sane criminal. The jury found her guilty; but in consequence of proof that many members of her family had suffered from insanity in some form, it was thought that there might be some latent degree of insanity in her case, not discoverable by the ordinary methods of examination. This resulted in the commutation of her sentence.

It would be dangerous to treat an accused person as insane merely because some of his relatives have shown instability of mind. Unless such instability is found in the accused, no importance can be attached to the family history.

The extent to which a family disposition to insanity persists throughout succeeding generations is very remarkable; but the truth is difficult of ascertainment unless the information can be obtained from someone who is well acquainted with the family. There is no matter upon which persons in every station of life are more desirous of concealment; and relatives are always ready to deny the existence of a family taint.

2. **Personal History.** The alleged criminal may be a sufferer from congenital mental disease; or he may have been previously certified as a person of unsound mind; or he may not have been so certified.

The idea underlying the phrase "lucid interval" is recognised by both law and medicine, for persons of unsound mind occasionally recover for a longer or shorter period to such an extent that they are fully conscious of their actions.

Lawyers contend that during the "lucid interval," a person should be held responsible for his acts; alienists, however, contend that the perpetration of the criminal act proves the reappearance of the insanity, and that therefore there can be no responsibility.

Recovery is *always a comparative* matter, and a person who has once been under treatment in a mental hospital, should not be allowed to return to the same circumstances of strain which caused the original breakdown. The following cases are much too common, and ought to be made impossible:—

(1) A woman was charged with the murder of her daughter, aged six. The child refused to go to school, and later the school attendance officer called at the child's home. The mother seemed worried, and soon afterwards neighbours heard shuffling sounds upstairs in the cottage, followed by an agonised cry. A couple of hours later, a neighbour saw the mother in her garden covered with blood. She said, "I have hit my little girl. Go upstairs and see if I have hurt her." The child was found on the bedroom floor with her head battered in, and a coal hammer lying beside her. When charged with the murder, the mother said that she knew nothing about it. She had been in a mental hospital, and there was medical evidence that at the time of the crime she was not responsible for her actions. She was found guilty, but insane.

(2) A woman who had been discharged as cured from a mental hospital, was out for a walk with her son, when he suddenly missed her. She was found later in

the evening, when she stated that she had thrown a boy into the canal. The next morning the parents of a little boy, aged six, notified the police of his disappearance. Connecting the circumstance with the woman's statements, the police commenced dragging operations, and the body of the missing boy was recovered from the canal. When arrested and charged with causing the death of the boy by drowning him in the canal, the woman made no reply.

When a person who has never been certified as insane, is charged with a crime, the whole of his past life should be thoroughly investigated in order to ascertain whether he has been or now is insane. Occasionally it is easy enough to determine that if he has never been certified, it is only because his friends and others have not thought it worth while, or because his conduct has not been sufficiently outrageous to justify committal to a mental hospital; again, the whole environment of his early life educationally and morally may have been such as to lead to an obliteration of the dividing line between vice, crime, and insanity. More frequently, however, attempts will be made to show that one of the known causes of insanity has been operative, and that after its operation the person was said to have acted queerly, to have been subject to fits of passion or to delusions, in other words, to have exhibited such a change in his normal conduct as to suggest at least temporary insanity. It is impossible to enter fully into all these causes and the way in which they act, but we may briefly glance at a few of them.

Accident to the head, violent shocks, sunstroke, starvation, fevers and excessive worry are often stated to be predisposing factors.

The puerperium, pregnancy, lactation, and other affections of the female generative organs are known occasionally to produce a mental condition in which a mother may not be responsible for her acts; puerperal mania is frequently associated with homicidal violence inflicted on a child. The killing of the child is usually either the result of a sudden fit of delirium or a sudden impulse, with a full knowledge of the wickedness and illegality of the act. The legal test of responsibility can be applied to such cases only on the assumption that insanity already exists. Women have been known to ask that the child may be removed, but have afterwards seized an opportunity for killing it. Such cases are distinguished from deliberate child-murder by the fact that there is no motive, no attempt at concealment, and no denial of the crime. In this connexion the merciful provisions of the Infanticide Acts should be borne in mind.

Where there is a history of epileptic fits relating to an accused person, a defence of irresponsibility is often raised. Although the effects of infantile epilepsy may often be exaggerated by the defence, there is no doubt that continued epilepsy causes dementia, and during that progress of the disease, destructive impulses may be produced. The reader should consult any modern text-book on insanity for details of the relation between epilepsy and insanity.

In *R.* v. *Perry*,[1] it was decided that, in order to sustain the defence of insanity, epilepsy must be proved to have existed at the time of the commission of the crime. The Lord Chief Justice of England said that it must be shown that the man was suffering from an epileptic seizure at the time when he committed the murder. The medical witnesses were unable to indicate any test by which the court could distinguish between the acts of a sane man and those of an insane man.

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[1] (1919), 14 Cr. App. R. 48.

Where there is a previous history of delusions, the defence may succeed, for delusional insanity is a more or less distinct class of insanity, and it is as to delusions, *and their nature*, that most of the differences of opinion between medical men and lawyers exist. The existence of a delusion, *if it can be definitely proved to be genuine*, is accepted by medical men at once as a clear proof of insanity, but the lawyer demands further evidence, he requires proof (1) that the delusion was connected with the offence, and with the person against whom the offence was committed ; (2) that the delusion was so dominant in the mind of the accused as to prevent him from knowing the distinction between right and wrong ; (3) that the delusion was so strong as to lead to an irresistible [1] (not simply unresisted) impulse to commit the act.

3. **The Surroundings of the Offence itself.** There are exceptions to almost every one of the following factors, but in combination, they afford weighty evidence of insanity.

(*a*) *Absence of Accomplices.* The lack of ability to act with others is, perhaps, the most striking feature of insanity ; hence it is a rule that when a person of unsound mind commits a crime, he does not confide in anyone.

(*b*) *The Motive.* The crime committed by a person of unsound mind is frequently without motive, or rather it is in opposition to anything that could be called a sane motive. A man, known to have been devoted to his wife and children, murders them ; a fond mother kills her infant. It cannot be asserted as general propositions that persons who are sane never commit a crime without an apparent motive, and that, in the perpetration of a criminal act, an insane person either never has a motive or has one of a delusive nature only. In any such proposition the fact that no motive is discovered is taken as a proof that one does not exist. That motives, however, may exist without their being discoverable, is proved by the numerous recorded confessions of criminals before execution in cases in which until the confession was made, no motive for the crime was discovered.

Crimes have sometimes been committed without apparent motive by presumably sane persons who were at the time perfectly aware of the criminality of their conduct. No indication of insanity or of delusion could be discovered, and they had nothing to say in their defence ; they have, however, been held responsible. On the other hand, patients in a mental hospital have been known to be influenced by motives in the perpetration of crimes ; thus they have often murdered their nurses in revenge for ill-treatment. An absence of motive when there are indications of insanity is a presumption in favour of insanity ; but the non-discovery of a motive for a criminal act cannot of itself be taken as a proof of the existence of insanity or homicidal mania. On the other hand, the existence of such a motive (jealousy or revenge) as would instigate a sane man to commit murder, is not of itself a proof that the person is sane and responsible.

A young imbecile had childish manners, and among the symptoms of imbecility was a strong propensity for watching windmills. He particularly wished to be tied to one of the arms of the mill when they were going round ; he would go any distance to see a windmill, and would sit watching one for days together. His friends removed him to a place where there were no mills, in the hope that this strange propensity would disappear. He collected a number of matches and set fire to the house where he was living in order to escape during the confusion to some imaginary land of windmills. On another occasion he enticed a child into a wood, and, in attempting to murder it, cut with a knife and mangled its limbs in a horrible manner.

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[1] Mercier stated emphatically that we have and can have no knowledge of an irresistible impulse ; all we can know is that it was not resisted.

How would any sane person have connected this propensity for windmills with the attempts at arson and murder? Yet it turned out that he had decided to commit these crimes in the hope that he would be removed to a place where there was a mill; and in such a place he was placed under treatment. He had employed definite means to secure a definite result; and he succeeded.

A distinguished criminal judge wrote:—

> "Melancholia, mania, and the delusions arising from them, often supply powerful motives to do destructive and mischievous acts; and cases occur in which an earnest and passionate desire to do such acts is the first and perhaps the only marked symptom of mental disease. It is probable that in such cases some morbid state of the brain produces a vague craving for relief by some sort of passionate action, the special form of which is determined by accidental circumstances; so that such impulses may differ in their nature and mode of operation from the motives which operate on sane and insane persons alike."[1]

The doctrine of "**irresistible or uncontrollable impulse**" and the theory of impulsive insanity have been strained to such a degree as to create in the mind of the public a distrust of medical evidence on these matters. It is easy to convert this into a plea for the extenuation of all kinds of crimes where motive is not apparent; and thus medical witnesses expose themselves to criticism. They are certainly not justified in setting up such a defence, unless they are prepared to draw a clear distinction between impulses which are "unresisted" and those which are irresistible.

In *R.* v. *Allnutt*, a boy aged twelve, was convicted of poisoning his grandfather in circumstances indicative of sane contrivance and deliberation. The medical evidence failed entirely to show that the boy was or ever had been insane in a legal sense. The judge who tried the case said that the witnesses called for the defence had described the prisoner as acting from uncontrollable impulse, and they had made other statements, of the value of which it would be for the jury to decide; but he must say that it was his opinion that such evidence ought to be scanned by juries with very great jealousy and suspicion, because it might tend to the justification of every crime that was committed. What was the meaning of not being able to resist an impulse? Every crime was committed under an impulse, and the object of the law was to compel persons to control or resist these impulses. If it was made an excuse for a person who had committed a crime that he had been goaded to it by some impulse which medical men might choose to say he could not control, such a doctrine would be fraught with very great danger to society.

The defence of irresistible or uncontrollable impulse has been raised in several cases in recent years, and in *R.* v. *Holt*[2] the Court of Criminal

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[1] Stephen: "Hist. of Crim. Law of England," II., 145.

[2] (1920), 15 Cr. App. R. 10.

Appeal declined to extend the tests laid down in *McNaghten's* case so as to include "uncontrollable impulse." The Lord Chief Justice said: "It is not enough for a medical expert to come to the court and to say generally that in his opinion the criminal is insane. There must be some evidence of insanity within the meaning of the rule in *McNaghten's* case." In *R.* v. *Kopsch* [1] the Court of Criminal Appeal laid it down that the defence of uncontrollable impulse is unknown to English law. The court expressed the view that "the defence of insanity in this case, as in so many cases," was "the merest nonsense"; and that "if the fantastic theory of uncontrollable impulse were to become part of our criminal law, it would be merely subversive.

If the law were to be relaxed in the way suggested by some medical men, it is feared by lawyers that the result might be to transfer to a section of the medical profession the question whether a great number of ordinary criminals should be held responsible to the law.[2]

In this connection, reference should be made to *R.* v. *True.*[3]

As to motive, the general rule is that an insane criminal never murders in order to acquire property; almost invariably his motive is simple and personal, such as revenge or a wish to take life.

In *R.* v *Bond*, a plea of insanity was raised in somewhat unusual circumstances.

The accused, who was sixty-three, was charged with having committed indecent assaults upon a number of little girls. Only two charges, however, were proved, and the facts alleged were substantially admitted.

An experienced alienist said that he had examined the accused and found him suffering from senile brain decay, with inability to manage himself. He was suffering from vascular degeneration of the body and brain, as evidenced by the actual state of the arteries, attacks of giddiness with temporary confusion and loss of memory, and numbness of his limbs, which had progressed during the last eighteen months. The accused was undergoing progressive deterioration. When questioned as to the acts complained of, he was not able to verify or to deny them. His will power was defective, and he suffered from constantly recurring ideas of a perverse sexual nature which were imperative and uncontrollable. The accused was aware of the immorality and illegality of the acts attributed to him. He required medical supervision and treatment. The witness was prepared to give a lunacy certificate in such a case.

Mercier gave evidence to the like effect, and stated that he would probably have given a lunacy certificate in the circumstances.

(*c*) *The victim* (*or victims*), *and the number of them.* The victims of a sane criminal are those who oppose his desires or his wishes, whereas the victims of a person of unsound mind are very frequently those who are either indifferent to or who are the most dear to him.

Where a sane criminal commits a murder, one person, or at the most two, may be killed; but, in cases of homicidal mania, it is not unusual to find a wife and several children killed by the husband, or four or five children simultaneously killed by the wife. These atrocities are as common among those who are insane as they are unusual among the sane. No motive other than that of an insane delusion could be suggested for such a series of murders. For example, several infants may be murdered by a mother, who admits the act, but endeavours to account for it by asserting that she wished to convert them into angels, or to save them from destitution or exposure to worldly temptations.

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[1] (1925), 19 Cr. App. R. 50.

[2] "The Criminal Law and Insanity," by Lord Hewart "Essays and Observations" (1930) *op cit.*

[3] *Supra.*

The following is a typical case of absence of motive :—

> A clerk aged thirty-two, was charged with the murder of his two children, a girl aged five and a boy aged three. No motive for the crime could be ascribed, as the accused was a devoted father and husband, and was not addicted to drink or to any bad habits. During war service in the East he had suffered severely from malaria. The prison surgeon stated that in his opinion the malaria would be a contributing factor in developing latent epilepsy. Without hearing the evidence for the defence, the jury found the prisoner guilty but insane.

(*d*) *The subsequent Conduct of the Accused*. He rarely seeks to *escape*, but delivers himself up to the police, and acknowledges the crime with which he is charged. This is a common feature of homicidal mania. A sane criminal usually attempts to conceal all traces of the crime, and he usually denies it to the last.

On the other hand, it sometimes happens that sane persons who take the lives of others through revenge or anger, commit the murder openly, and make no attempt to deny or to conceal the crime, for the simple reason that denial or attempt at concealment would be hopeless.

Again, a morbid love of notoriety will often induce a sane criminal to attempt assassination in circumstances where the attempt must necessarily be witnessed by hundreds of people, and where there can be no possibility of escape.

In *R.* v. *Harold Jones*, the prisoner, a lad aged fifteen, pleaded guilty to murdering a little girl. He had confessed to having killed another child six months before. He had been acquitted by the jury on the first charge ; and when he returned to his native town, he was made the object of a friendly demonstration by the inhabitants. This seems to have affected his morbid vanity and to have led to the second murder. There was evidence that the lad was suffering from disease of the mind in which there was a strong sexual element of abnormality.

General Summary and Cases

As a result of the researches of alienists who have been studying problems connected with the insane, and of psychologists and humanitarians who have promulgated new views on the subject of the reform of criminals, the views formerly held as to the criminal responsibility of the insane have been modified during the past fifty years.

Whereas " madhouses " were formerly conducted for private profit, mental hospitals are now managed by public authorities who employ the best available medical talent with excellent results. Formerly, long terms of penal servitude, solitary confinement, and prison discipline, were considered to be the only methods of dealing with criminals ; but it is now being taught that less unsatisfactory results can be achieved by means of education and compulsory training accompanied by appropriate supervision and discipline.

Sanity and insanity are regarded no longer as matters of simple fact, but as matters which call for trained observation. That certain people are sane and that certain others are palpably insane may be a fact; but there is nothing except conduct to *prove* whether those on the border line are sane or insane.

In this connection, the law of England divides insane persons into two classes: (*a*) those upon whom the sanctions of the criminal law have no effect, and whom therefore it would be cruel to punish; and (*b*) those whose form of insanity is only such that, to use Lord Bramwell's apt test, "they would not have yielded to their insanity if a policeman had been at their elbow."

If the punishment of death were abolished, it is probable that the plea of insanity would rarely be raised. In this connexion, Professor Kenny wrote: "Careful observation of insane patients, in various countries throughout many years, has now thrown light upon the mental processes of the insane. The world, it is now recognised, is full of 'warped' men and women, in whom there exists some taint of insanity, but who nevertheless are readily influenced by the ordinary hopes and fears that control the conduct of ordinary people. To place such persons beyond the reach of all fear of criminal punishment would not only violate the logical consistency of our theory of crime, but would also be a cause of actual danger to the lives and property of their neighbours. Where insanity takes any such form, it comes clearly within the rule of criminal legislation propounded by Bain: 'If it is expedient to place restrictions upon the conduct of sentient beings, and if the threatening of pain operates to arrest such conduct, the case for punishment is made out.'"

In giving an opinion of the mental condition of an accused person, a medical witness should not modify that opinion, having regard to the *punishment* which may follow if the plea be rejected, but should confine his opinion to the medical *facts* of the case. The legislature alone is responsible for the punishment of crime. A medical witness is summoned to a court of justice in order to assist the judge and jury in their deliberations. The question proposed to him involves a simple fact, and not its consequences. The determination of the question whether the accused is a responsible agent is of a judicial nature; medical evidence should be confined to the question whether the accused is *insane* as defined by law.

It is impossible to lay down any rules applicable in all cases. Each case must be decided on its merits and on the circumstances attending the crime.

The following cases not only illustrate the above propositions, but indicate the sort of line which lawyers may be expected to take, and the form of examination and cross-examination which medical men must be prepared to undergo.

A man, aged 25, was indicted for the murder of a little boy by cutting off his head with a razor. The sister of the victim, aged 10, gave evidence that the prisoner had "insulted her," and then gone off with her brother, who was found with his head cut off. It was proved that the prisoner had had "fits" as a boy, but not since.

A medical witness was asked:

Assuming that you had these facts proved: the case of a man whose father had three times attempted to commit suicide; a man who himself as a child had had fits; and when he was fifteen years of age, some affection of the brain from which he was more or less unconscious for three weeks—in what direction would those facts point ?—They would point to a man being possibly or probably insane.

Assuming it was also proved to your satisfaction that the prisoner's conduct two years before the alleged crime was this : Calling out of the window for an imaginary cab, and on getting no answer putting his fist through the glass of the window. On being checked from doing this, threatening to cut the throat of the person who checked him. Assuming also that it has been proved to you that prisoner had been in the habit of beating the pillow of his bed with the poker and threatening somebody he believed to be in the pillow, when no such person existed at all. When sitting quietly cleaning his soldier's clothes, suddenly getting up and throwing things at what he thought was on the wall. Being found by himself in a room with a bag of shavings suspended in some way from the roof and punching it till the sweat was streaming off him. Assuming that at times the prisoner never spoke a word for long periods together, and being dull and despondent, if you were satisfied of the truth of these facts, in what direction would they point as regards his criminal responsibility ?—They would point to his suffering from delusions either from drink or insanity.

Put the matter of drink entirely out of the question.—It would point to delusions. I should not take much notice of punching a bag of shavings ; anybody practising for boxing might do that.

Would the other things point to his being an insane man ?—They would point in that direction, and he ought to be examined by one skilled in examining the insane.

If you find some person talking and muttering to himself, and complaining of feeling queer and wanting to kill somebody, what would that point to ?—If the man was really expressing his feelings it would point to insanity.

Suppose a case in which all the things I have put to you were proved to be the past history of the prisoner, and the crime itself was without motive, and of great ferocity, would not all that point to the fact that a person was not criminally responsible for his actions ?—Certainly it would point in that direction.

Is it possible for a man to do all those things mentioned in cross-examination, and yet know right from wrong ?—I think a man might do all these things and yet know right from wrong in the ordinary sense of the term.

The resident physician at St. Andrew's Hospital, said he had made diseases of the mind a special study, and had been thirty-three years at St. Andrew's Hospital, and before that five years Superintendent of Salop County Asylum. He had examined the prisoner, and had certain evidence before him. One soldier told him that the prisoner after an outbreak told him he had murderous instincts. On October 6th, the prisoner's manner was very strange, and when questioned as to what happened on the day of the crime the prisoner laughed, and also laughed at a warder. Witness thought that the prisoner's manner was genuine. On October 20th he was in much the same condition, and when asked why he laughed on the previous occasion, said, " I know that when you talked to me about my position I laughed. I could not help it. Sometimes a dizzy feeling comes over me, and, although I knew it was wrong to laugh, I could not help it. In barracks I sometimes had these feelings, and sometimes fainted on drill. I do not remember the things the other soldiers say occurred in barracks." The witness believed prisoner to be insane. He should say that his mind had been affected for some time.

Do you think that on July 10th the prisoner would have been in such a condition as to do a cruel act without knowing it was wrong ?—I think he was suffering from homicidal mania, and a person suffering from that disease might be apparently sane at the time he committed a crime under an impulse he was unable to control.

Would that be an impulse he would be unable to control if a policeman were standing by ?—Certainly.

Do you think that seeking to cover the body with grass consistent with homicidal mania ?—I do.

Have you any reason to think that on July 10th this man had homicidal mania ? —I believe he had, and I have formed this opinion from my knowledge of similar cases.

Would a strong motive for killing this boy make any difference in your opinion as to homicidal mania ?—No. I think homicidal mania may have an object to work for.

Suppose he tried to conceal the crime, would that make any difference ?—No.

Under any circumstances you then think that the prisoner had homicidal mania ?—I believe so.

Is that opinion founded upon the supposition that prisoner early in life had fits ?—Partly.

Assuming that all the facts were accurate, except that as regarded the fits, would your opinion be altered ?—Not at all.

In summing up the case to the jury, the Judge reviewed the evidence, and called their attention to the marks of blood upon the clothes of the prisoner and the discovery of the razor as being relied upon by the prosecution to prove that he committed the crime. As to the question of motive, that was, he said, a point for them also to weigh. It certainly might tend to show a reason for the commission of the crime, but otherwise it was immaterial whether it existed or not, as the murder was committed. Referring to the question of insanity, the judge said that a man did not get rid of his responsibility for a murder or any other criminal act on that ground unless he was in such a state or defect of understanding brought about by mental disease that at the time he committed the act he was incapable of distinguishing whether what he was doing was right or wrong. The jury would have to say whether, if they thought the prisoner was guilty of the crime, he was in such a state of mind as to know right from wrong when he did it. His lordship dealt with the evidence brought forward on that point by the defence. Concluding he asked the jury to say whether they found the prisoner guilty of the murder, and if they did so find him guilty, then whether or not they thought that at the time he committed it he was insane, so that according to law he was not responsible for his actions.

In *R.* v. *Rodgers*, a boy aged 15, was charged with the murder of his mother, who was an habitual drunkard.

The elder sister related how that she, the accused, and a little sister, had supper together on the evening of the 12th, the mother being in the room under the influence of drink. After supper the accused entered the drawing room with a revolver in his hand, and exclaimed, "I have shot her ; I thought it best." Later that night the accused said that he did it for the sake of the little sister, who, he said, could not be brought up to the life they had led for the last few years.

In cross-examination, another witness (a brother) said that the accused had been strange in his behaviour for about six weeks before the tragedy. He had strange fancies, and one morning at breakfast said he had dreamed that he had strangled his mother.

The family physician said that he had noticed the accused's extraordinary behaviour. After the tragedy the boy told him that he distinctly heard a voice tell him to do it quickly.

An expert in mental diseases gave his opinion that the boy was of unsound mind when he shot his mother.

The Judge : Do you mean there was a warping influence greater than or other than the influence of passion ?

Witness : Yes.

In cross-examination, witness said the murder was not merely an act done on the impulse of the moment, but that it was an act which the prisoner had considered beforehand.

Similar evidence was given by two other experts in mental diseases. One of the latter said : "I consider him not to be of sound and right judgment, but find no other definite symptoms of insanity at the present time from my conversation with him. Giving all weight to the circumstances within my knowledge, I have formed the opinion that at the time of the commission of the act he was in a state of morbid mental exaltation, during which he made some effort to resist, and at last suddenly yielded to a recurrent impulse to commit a crime for which an immature judgment had for some time led him to believe there was moral justification."

Evidence of insanity on the mother's side was given by a brother of the deceased.

The husband of the deceased said that he took the house in the country because of home troubles. He thought that his wife would be away from the means of getting drunk. Great affection had existed between the accused and his mother.

The jury found the prisoner guilty, but that he was insane at the time of the murder.

In *R.* v. *Edwards*, the prisoner was charged with the murder of a man and his wife and their little child.

With a heavy sash-weight (weighing five and a half pounds), the prisoner was alleged to have murdered a man and his wife, and then to have strangled their little child; the bodies of the parents were then cut up and removed in sacks and buried in a garden at Leyton. In consequence of an unprovoked attack upon another man, suspicions of the murder were aroused and the bodies were then found. A defence on the ground of insanity was raised, and the following evidence was given.

A medical witness said: "I saw six sacks containing the dismembered bodies of a man and woman; the heads and limbs had been cut off. I also saw the body of a child, which was intact. The heads were quite recognisable. The cause of death was due to injury to the heads in the cases of the man and woman, and in the case of the child to strangulation; there was a handkerchief tied tightly round its neck—there were extensive fractures to the skulls of the man and woman—there had been three or four blows delivered—the face of the woman had been smashed in, and there had also been a blow on the back of each of their heads—the serious blows had been struck from the front—the blows on the back of the heads were not of a serious nature, they might have been done in falling—the bodies had been dismembered by means of a saw. I should say that in each of the two cases the cause of death was from a blow which had been delivered from the front—I cannot say if it was the first blow or not—the blows were undoubtedly tremendous and ferocious."

As regards evidence of insanity, another medical witness said: "I should imagine that the attack on these unfortunate people was a very ferocious one—we group the predisposing causes of insanity into mental and moral ones—heredity and stress may be predisposing causes, but I do not think you can bring them all into two groups—there are very many types of insanity—if on the maternal side of a family you can trace insanity for some time past, that might be a predisposing cause to insanity in an individual, but I should require to know the extent of it if I was reporting to an asylum—if it began with the prisoner's grandfather's sister, and was traced to the brother of the prisoner's mother, and then to two or three of the prisoner's nieces, that would be a close connection of insanity in the family—if I had to report on a case like that, I should report that those were possibly predisposing causes—if it was undoubted insanity, and radiated to nieces and sisters in a collateral way, it would be stronger than missing a generation—if there is a depression at the back of the prisoner's head which was the result of an accident some years ago, it might come under the head of stress, but I cannot say without examining it—if there was a depressed fracture of the skull, that might be so; assuming that to be so, the thickening of the bone might lead to atrophy of brain—pressure of the brain, which you might discover by symptoms or the X-rays, might possibly lead to insanity—I do not think you could discover it by touching or feeling—insanity sometimes skips a generation—I know the facts of this case; from my experience, I should not say that many of the acts in it are those of a person of unsound mind—I do not know that I should consider the weapon with which the murder was committed a very extraordinary one—it is a very effective one—I should think a weapon of this kind is a very easy thing to obtain, as they are to be found in every house—I cannot say that I have ever heard of a sash-weight having been used before for such a crime—looking at the case from an ordinary point of view, one would say that to commit these wholesale murders would be scarcely worth the while—I should not say that the doing of it is an indication of insanity—I have been connected with similar cases, where over-anxiety about detection had not been noticed in persons who were described as sane, and who were never found to be to the contrary; in those cases insanity was set up as a defence, but two of them were not successful—a sane person is not always over-anxious; it depends on temperament; many people are callous without being insane—I do not think it is an indication of insanity to commit wholesale murder; there is no reason why a man who does so should not be insane, but I should like to know the facts of the case before I decided—it is decidedly exceptional to meet with a case of wholesale murder—I can recollect a case in which there were two murders committed, but never three in my personal experience—it is very common in cases of insanity for an insane person to be controlled and influenced by the same motives which actuate persons who are sane, but 99 per cent. of the cases of insanity are not insane altogether, they have got many sane sides—violent impulses to acts of murder or homicidal attacks may be dormant in an individual for a long time without showing outside expression—a person may not show to the outside world evidence of the conflict going on inside his mind, but there may not be any such conflict—those people may have uncontrollable destructive impulses, but whether the person knows the difference between right and wrong at the time is the debatable point—there are some eminent medical men who hold that insane persons may commit an act knowing it to be wrong, but are unable to control the impulse to commit it—there are some cases in which the act itself is the chief evidence of mental disorder in the individual—in the majority of cases of homicidal mania the person who commits the act does not seek to obliterate all traces of the crime; they are quite indifferent to the traces—my experience of criminals is that indifference as to concealing the act is a characteristic of insanity—I should say that in the majority of undoubted cases of insanity, persons are indifferent as to obliterating traces of the crime when acts of this sort are committed—persons do not always show great calmness, but they do show absence of fear; they sometimes show great cunning and ingenuity, but at the same time they may be quite indifferent in effecting concealment and indifferent to the number of lives they take—I do not say that that is evidence of insanity, but it is a frequent consequence; it is more likely to be associated with an unsound mind than with a sound one—I should say it is probably the case that an insane person committing a murder would not have accomplices, however colossal the scheme may be—an insane person suffering from a homicidal paroxysm might kill any number of persons, but so might a sane person—I do not say he would do so without a motive—I cannot say what is sufficient motive—a sane person committing an act which might forfeit his life might not have a sufficient motive—I have known a few pounds to be sufficient motive, where there was no evidence of insanity."

Re-examined.—"Homicidal uncontrollable impulses are generally sudden—a person who is subject to them would not lay his plans some time beforehand—the plans would, of course, be just as suddenly arranged as the act—I have not examined the prisoner nor his family history."

The unprovoked assault is thus described by the victim:

"I was at the prisoner's house at Leyton to discuss some business matters with him—I was with him several hours—he paced about a great deal and apologised for keeping me waiting—there was nothing in his manner to cause me to fear him in the slightest—his attack was absolutely unprovoked, and took place in a moment—he gave me a very severe blow, it almost knocked the senses out of me, and it was followed by a number of blows rained upon me while I was on the ground—in another moment he might have killed me—towards the end of the attack he tried to force a handkerchief or cloth into my mouth—he was almost exhausted by the force of his own blows—he began to show signs of fatigue—I had a hat on at first—I cannot say when I lost it—I was taken away from the house—I think the prisoner might have attacked me at any time while I was in the house—we were on perfectly good terms—I found him a pleasant man—I did not know what became of him after the attack."

The prisoner's uncle said: "I have not seen him for thirty or forty years, when he was ten or twelve years old—his mother's brother died a lunatic—he lived for many years with the prisoner's mother—the father of the prisoner's mother had a married sister who had been in an asylum, and who never regained her faculties—my daughter is at present in a private asylum—I have two other daughters who are now in a precarious condition as to their mental health.—The prisoner's father died a confirmed dipsomaniac—he squandered in drink the fortunes of his wife, his two sisters, and his mother."

The medical officer of Brixton Prison said that the prisoner had been put under close observation and that he had seen nothing to indicate insanity.

Cross-examined. "I had some written statements as to the prisoner's family history; the shape of his head is somewhat peculiar, one part is more prominent, with a slight depression on each side—he says that he had a fall about fifteen years ago—there might be some thickening of the bone, which might cause local pain—it would not necessarily affect his brain—it might lead to some affection of the brain, but not necessarily to atrophy—cases where wholesale murders are committed are unusual—there might be strong original taint where insanity runs in collateral branches of a family—indifference to human life is frequently shown in cases of homicidal mania—insane men often use the same methods and have the same motives as sane men—they show a good deal of cunning and ability in concocting their schemes—people who become insane often have colossal schemes; the mind in a way is always at work; schemes which would be impossible to a sane man—a person might be suffering from homicidal mania and not show any outward signs that he is likely to commit a terrible crime—homicidal impulses would not last over any length of time—it is possible, but not usual, for homicidal mania to return with uncontrollable impulses—cases of so-called homicidal impulses are not numerous—no murderer is normal, and it is very seldom that the motive for the murder is adequate—a murderer is a departure from absolute soundness, although not legally insane—I should not necessarily describe him as mentally weak—my opinion is that in this case there are things which a man who was in possession of his faculties might do. If there had been any thickening of the bone of the skull affecting the brain, I should have expected to find symptoms of it—I found no symptoms of insanity in this case." Verdict: Guilty. The Prisoner: "Now get on with it as quick as you like." Sentence: Death.

Disgust at the cold-bloodedness of the crime seems to be the only reason why the prisoner was not found insane; and the case indicates the nature of a modern trial and the circumstances which influence a jury.

The question arises whether a person should be held responsible for a **criminal act perpetrated in that half-unconscious state which exists when he is suddenly aroused from sleep.** The mind is at this time subject to hallucinations and illusions, which may be more active and persistent in some persons than in others. A case of this description will be found reported by Marc.[1]

A man suddenly awoke at midnight, and saw before him, as he believed, a frightful phantom. He twice called out, "Who is that?" and receiving no answer, and imagining that the phantom was advancing upon him, he seized a hatchet, which was beside him, attacked the spectre, and it was found that he had murdered his wife. He was charged with the murder, but pronounced "not guilty" on the ground that he was not at the time conscious of his actions.

A trial involving this question took place in England many years ago:—

A pedlar who was in the habit of walking about the country armed with a sword-stick, was lying asleep on the high-road, when he was awakened by a passer-by who seized and shook him by the shoulder. The pedlar suddenly awoke, drew his sword, and stabbed the man, who died soon afterwards. The pedlar was tried for manslaughter. His irresponsibility was strongly urged by his counsel, on the ground that he could not have been conscious of an act thus committed while in a half-awake state: this defence was supported by the opinion of a medical witness. The prisoner was, however, found guilty

When enmity exists as a motive for the act of homicide, the murderer, while sleeping in the same room, may select the night for an assault, and perpetrate the act in darkness in order the more effectually to screen himself.

In *R.* v. *Jackson*, the defence was that the accused (a woman who slept in the same room), inflicted the wound owing to some sudden impulse during sleep. It was proved, however, that the accused was actuated by malice towards the victim, and that she had wished him dead. The knife used for the wounding had been recently sharpened, and the accused must have reached over the victim's wife who was sleeping in the same bed with him, in order to inflict the wound. These facts were inconsistent with the suggestion that the act had been perpetrated in a state of unconsciousness in awaking from sleep; and the prisoner was convicted.

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[1] *Op. cit.*, vol. 1, p. 56.

It cannot be denied that **mania may sometimes show itself by excessive sexual desires** leading to attempts by one on the other sex. When the disorder of the mind is established from evidence of the general conduct and conversation of a person, no difficulty arises; but when, on a charge of rape, it is alleged that the assailant was unable to control his desires, it becomes a question how far such a defence is medically and legally admissible. Excessive amorous propensities may exist in sane and responsible persons, and if unresisted by due moral control they may in a certain sense be described as irresistible, but evidence to that effect would not justify a jury in finding an accused man not guilty in a case where the time and circumstances were especially suitable for committing such a crime. The sane ravisher will generally seek his opportunity; the real maniac will attack any woman openly and indiscriminately.

Such a defence is rarely set up in a case of rape, for the reason, no doubt, that all the circumstances of the case would be adverse to it. In a case tried at Glasgow, the defence of insanity was raised in a trial for criminal assault on a woman.

The crime was committed on November 12th. On the following day, in his examination, the accused, a married man, aged 40, appeared to be calm and collected and in no respect different from other men. The account he gave of the transaction was that he thought that he was under the influence of the magistrates, and that he would lose his life if he did not have connection with the prosecutrix. After a struggle together, he committed the act. His mother stated that he had been subject to epileptic fits, which left him in a stupid state and scarcely conscious of his actions. He also suffered from delusions. A few days before the commission of the crime, he had had several seizures of more than usual violence, and it was suggested that at the time of the act he was under the influence of some of his delusions. The jury returned a verdict of "not guilty on the ground of insanity."

The act was perpetrated with a proper attention to opportunity, and under the same animal impulse as would have been manifested by a person not subject to epileptic fits. There was no proof that his insanity had shown itself on previous occasions in a sexual form, nevertheless, the history of the case suggests the possibility that the crime was perpetrated when the accused was in a bemused mental state from his epileptic fits

The crime of poisoning indicates malice and deliberation in a greater degree than it would be safe, as a rule, to admit as co-existing with a state of irresponsible insanity. For this reason, a defence of insanity in cases of murder by poisoning has generally ended in failure, even when there has been relatively strong evidence, both personal and hereditary, in support of the contention. In point of fact, it is fairly uncommon for insane people to resort to poisoning, although there have been instances of their doing so.

In *R. v. Edmunds*, the accused woman (aged 43), who moved in a respectable sphere of society, was charged with the murder of a boy at Brighton. The boy ate some sweets purchased in a confectioner's shop, and died in a short time with the symptoms of poisoning by strychnine; strychnine was found in his stomach.

The accused had procured sweets from this shop by the agency of boys; and, having deliberately added strychnine, returned the sweets to the shop. She had herself on various occasions left poisoned sweets about in shops. How many persons had suffered from this cold-blooded and reckless act is not known, but she had previously attempted to poison the wife of a medical man, and she imputed the poisonings to the carelessness of the confectioner, but he was able to show that his sweets as purchased were wholesome. By a chain of circumstances the crime of poisoning was clearly fixed upon the accused. She had shown much cunning in her activities. She had procured strychnine on four different occasions under false pretences, and had borrowed the poison-book of a druggist, and torn out the leaves to conceal the fact that she had purchased the poison.

The defence was insanity; but there was no proof of insanity. The accused had shown all the skill of an accomplished criminal in carrying out her plan of general poisoning, and in using the most artful means to conceal it and to throw the imputation upon the confectioner. Impulse could hardly be pleaded, for her criminal acts were extended over weeks and months. She was convicted. Then, with a view to averting or delaying punishment, she put in a false plea of pregnancy in bar of execution. The capital sentence was subsequently commuted on the ground of insanity. Her father died in a mental hospital when of middle age, having suffered for years from homicidal and suicidal mania; her brother died as an epileptic idiot; her grandfather was a subject of cerebral disease; her sister suffered from hysteria; other relatives were afflicted with nervous diseases of some kind; and she herself appears to have exhibited, some eighteen years previously, symptoms of hysteria and hysterical paralysis. This hereditary tendency to insanity in her family was the main cause of the commutation of the capital sentence.

This case should be compared with that of Mary Ann Cotton, who was executed for murder by poison. This woman killed by arsenic, in the most reckless manner, children, husband, relatives and friends, to the number of twenty persons. She sent her son, for whose murder she was tried, to procure the poison with which she subsequently killed him; but this woman was condemned and executed. She was unable to plead either hereditary taint or hysteria.

RESPONSIBILITY OF DRUNKEN PERSONS

The Effects of Alcohol on the Brain [1]

Alcohol can produce a condition of temporary alteration of the mind (known as drunkenness), varying in degree from a very slight alteration of the usual temperament (gay, morose, etc.), through a state of such gross alteration that the subject loses all control, ending in a condition of absolute unconsciousness which may deepen into coma and death. Mercier taught that a man who is drunk is mad as far as he is drunk.

The amount of alcohol required to produce any of these states varies with the age and state of health of the person as well as with his habits in relation to alcohol. For example, it requires a considerably greater quantity of alcohol to produce effects on a person accustomed to the use of alcoholic beverages than it does on a more temperate person. The effect, moreover, varies in the same individual at different times.

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[1] *Vide* Savage on "Insanity"; Maudsley, "Responsibility in Mental Affections."

Intolerance to alcohol which is very evident in certain people may be congenital, as in those with a neuropathic history, such as epileptics, or it may be acquired after prolonged fevers, sunstroke, or after injuries to the head.

A person, otherwise quite sound in brain, who habitually indulges in excess of alcohol, may eventually become permanently insane. In other words, alcohol may cause insanity, and this insanity does not disappear when the alcohol is no longer in the blood. That is to say, permanent changes in the brain tissues may be produced.

On the other hand, the brain may, *ab initio*, be abnormal in that there is an irresistible craving for alcohol ; in other words, insanity or degeneracy of the brain sometimes is the cause and not the effect of indulgence in alcohol.

Delirium Tremens. When alcohol is habitually taken to excess there is liability to an attack of *delirium tremens* (*a*) without other obvious cause than a bout of drink, or (*b*) on sudden deprivation of drink, or (*c*) on meeting with some shock or accident, or (*d*) on being attacked by some disease, *e.g.*, pneumonia. It is the general opinion that *delirium tremens* is due to sudden deprivation or serious decrease of the alcohol habitually taken, and that shock and disease have nothing to do with it except in so far that in their treatment alcohol is commonly omitted. It appears to be reasonably certain that the disease is not due to the direct action of alcohol, otherwise the condition should pass off within about forty-eight hours of the last bout of drinking, when the whole of the alcohol is eliminated.

Patients with *delirium tremens* are often violent, and prone to commit suicide or murder—more commonly the former ; hence they require close watching. Such persons are incompetent to the performance of any civil act, unless the mind should clear up before death : they are not responsible for criminal acts committed while they are labouring under an attack. Thus, then, although this disorder may have been voluntarily brought on by habitual drunkenness, the law admits it as a sufficient plea for irresponsibility. In *delirium tremens* there is probably an organic disease of the brain, while voluntary drunkenness merely produces a temporary disturbance of its functions.

In addition to *delirium tremens*, indulgence in alcohol may lead to certain other types of mental disease, namely, *polyneuritic insanity*, known as *Korsakow's disease*, in which illusions of memory and illusions of recognition are associated with peripheral neuritis ; *alcoholic hallucinosis*, in which auditory hallucinations and delusions of persecution are frequent ; *alcoholic dream states*, *alcoholic paranoia* and *general cerebral deterioration.*

Diagnosis of Drunkenness

For a description of the effects of alcohol and the diagnosis of drunkenness, see under " Poisoning by Alcohol," Vol. II.

Intoxication other than Alcoholic

Intoxication is simply poisoning by alcohol, a form of narcotic poisoning. A medico-legal question may arise in reference to the responsibility of persons for acts perpetrated while they are under the influence of other narcotics of a more powerful kind. Acute confusional insanity may arise in predisposed persons from the effect of cocaine, belladonna, datura, chloral, cannabis indica, and many other drugs, and from the toxins of many acute fevers. In this state there is great disturbance of memory, disorders of judgment leading to delusions and marked hallucinations. There may be great excitement and restlessness, which, in turn, may be followed by drowsiness, stupor, and muscular weakness. As a result of his hallucinations and illusions, a man in this state, like an insane person, may commit illegal acts. Cases involving a question of this kind are not very common in England.

A woman was charged with the murder of a child by strangulation. There was no obvious motive, and at the time of the murder, the accused was in a half-stupefied or unconscious state. She was in the habit of taking laudanum, of which she had taken a large dose on the morning of the day on which the child was killed. It was suggested for the defence that she was in such a state of mind as not to be responsible, but the jury convicted her of the murder.

Unless there is proof of confirmed disease of the brain as a result of the habit, a person who commits a crime while under the influence of drugs voluntarily taken, will no doubt be held as responsible for the results as if he were sane.

As to the habit of taking cocaine, see "Cocaine Poisoning," Vol. II.

Medical Views on the Criminal Responsibility of Drunken Persons

Savage says: "A person, say, is given powerful stimulants, masked or concealed in some way; or being weak, or suffering from an old injury to the head, an amount which formerly would not have affected him now produces a great effect; in a state of acute alcoholism he commits a crime, and doubtless would be considered not guilty; but if he has experienced several times the danger which he incurs by taking stimulants even in small quantities, and yet continues to indulge, and then perpetrates a crime, he may be justly considered responsible, even although it may be proved that by inheritance, or in consequence of injury to the head, he is especially liable to be affected by stimulants. Next, if in consequence of intemperance he becomes slowly affected by mental disorder, and in a state of *delirium tremens* he commits a crime, he will probably not be considered fully responsible. If instead of *delirium tremens* alcohol produces chronic insanity, and in this condition of genuine insanity he does harm, he will not be considered responsible for his acts."[1] Mercier says: "If he takes drink not knowing that it will make him mad, he should not be held responsible. If he does know by previous experience that it will produce such a kind of madness as is likely to result in crime, he should be held responsible." The degrees of responsibility from drink are here fairly stated from a medical point of view, but when a case is before a legal tribunal the problem does not appear so simple.

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[1] "Insanity." p. 465.

Legal Views on Criminal Responsibility of Drunken Persons

Formerly it was generally held that drink was no excuse for crime; but it is now well settled that total deprivation of self-control, or at all events delusions induced by excess, as in *delirium tremens*, may render a person irresponsible for his actions.

Whatever weight may be attached to the former rulings and opinions on this subject the position, so far as regards the law of England, has been settled authoritatively by a decision of the House of Lords in 1920, when the circumstances in which drunkenness may be a defence in a criminal charge were considered fully in *Beard's* case.[1] In that case the prisoner had been convicted of the murder of a child of thirteen. He ravished the girl while in a state of drunkenness; and, in furtherance of the act of rape, placed his hand on her mouth with a view to preventing her from screaming, with the result that the girl died of suffocation. The defence was that the man was so drunk that the jury ought to return a verdict of manslaughter. The judge who tried the case, directed the jury that this defence could prevail only if they were satisfied that, by reason of his drunkenness, the prisoner either did not know what he was doing, or did not know that what he was doing was wrong. Upon appeal the Court of Criminal Appeal followed the ruling in *R.* v. *Meade*,[2] and held that the judge ought to have put to the jury the further question whether the mind of the prisoner was so affected by drink that he did not know that what he was doing was dangerous. In these circumstances the Court of Criminal Appeal substituted a verdict of manslaughter.

In delivering the unanimous decision of the House of Lords, in *Beard's* case, the Lord Chancellor laid down the following general principles: "Insanity, whether produced by drunkenness or not (even though temporary), is a defence; and drunkenness which renders the accused incapable of forming the specific intent essential to constitute the crime should be taken into consideration, with the other facts proved, in order to determine whether or not he had this intent. . . . This is not an exceptional rule, applicable only to cases in which it is necessary to prove a specific intent, *e.g.*, intent to do grievous bodily harm. . . . This, on ultimate analysis, is only in accordance with the ordinary law applicable to crime. For, speaking generally, (and apart from certain special offences), a person cannot be convicted of a crime unless the *mens* is *rea*. Drunkenness rendering a person incapable of the intent would be an answer; as, for example, in a charge of attempted suicide. . . . Drunkenness falling short of a proved incapacity to form the intent necessary to constitute the crime, and merely establishing that his mind was affected by drink so that he more readily gave way to some violent passion, does not rebut the presumption that a man intends the natural consequences of his acts."

In applying these principles to *Beard's* case, the Lord Chancellor said: "In the present case, drunkenness could be no defence unless Beard, at the time of committing the rape, was so drunk that he was incapable of forming the intent to commit it (which was not the fact). The capacity of the mind of the prisoner to form the felonious intent which murder involved is to be explored in relation to the ravishment, and not in relation merely to the violent acts which gave effect to the ravishment. Death caused by an act of violence done in furtherance of the felony of rape is murder. . . ."

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[1] [1920] A. C. 479.

[2] [1909] 1. K. B. 895.

In commenting on the judge's direction to the jury, the Lord Chancellor said: "The judge should not have introduced the question whether the prisoner knew that he was doing wrong in a defence of drunkenness where insanity was not pleaded. Notwithstanding that the judges ever since *McNaghten's* case have used these questions as a test of insanity, there is no single case, where drunkenness has been the defence, in which the judge has directed the jury to consider whether the prisoner knew that he was doing wrong. The direction of the judge was an innovation not supported by authority."

The conviction of murder was restored.

Civil Responsibility of Drunken Persons

Any *deed* or *agreement* made by a person when drunk is not invalidated by English law, except in cases where the intoxication has proceeded so far as to deprive him of all consciousness of what he is doing. The law will not interfere in other cases, unless the drunkenness was the result of collusion by others for the purposes of fraud. When the drunkenness has occasioned a temporary loss of the reasoning powers, the person is incapable of giving a valid consent, and therefore cannot enter into a contract or agreement; for this implies *aggregatio mentium*, *i.e.*, a mutual assent of the parties. In *Matthews* v. *Baxter*,[1] A agreed to purchase some houses belonging to B. At the time of the contract, A was so drunk as not to know what he was doing. Afterwards, when sober, he ratified and confirmed the contract. It was held that both parties were bound by the contract.

If the person contracting knew what he was doing, partial drunkenness does not vitiate a contract or agreement.

The liability to pay a reasonable price for necessaries sold and delivered to a drunken person is upon a contract implied in law, and does not depend on actual agreement, the existence of which is precluded by the mental condition of the person to whom the goods were supplied.

Restraint of Habitual Drunkards

The Inebriates Acts, 1879 to 1898. The Inebriates Act of 1898 embodies several practical amendments of the Habitual Drunkards Act, 1879, two of which are of special importance. Voluntary applicants for admission to and detention in a licensed retreat can have their applications attested by *one* justice (instead of by two justices, as previously), and the period of detention for which an applicant can apply is doubled, that is, extended from one year to two years.

The period for which a licence for a retreat may be granted is also extended from thirteen months to two years.

The licensing local authority in a borough, is the borough council and the town clerk, and elsewhere the county council and its clerk, a county council being empowered to delegate any of its powers as a local authority to a committee.

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[1] L. R. 8 Ex. 132.

Power is given to any county or borough council, and to two or more councils in combination, to contribute to the establishment or maintenance of a retreat under the Inebriates Acts, 1879 and 1888, as amended by the Act of 1898.

The extension of a term of detention, or readmission, may be granted on attestation by one justice, without a statutory declaration, the attesting justice not being required to satisfy himself that the applicant is a habitual drunkard.

The time between escape from and return to a retreat is not reckoned as part of the term of detention. A warrant for the arrest of a patient who has escaped from a retreat may be issued by any justice having jurisdiction in the place where the escaped patient resides.

In the case of a patient dying while absent from a retreat on licence, a certificate by a registered medical practitioner of the cause of death, with the name of any one present at the death, and copies thereof must be duly certified by the person in charge of the deceased, and sent by that person to the coroner, to the district registrar of deaths, to the clerk of the local authority, and to the person by whom the last payment was made for the deceased, or to at least one of the persons who signed the statutory declaration under the Inebriates Act, 1879.

The Secretary of State is empowered to make regulations on all matters necessary or proper for carrying into effect the provisions of these Acts with respect to retreats, including the enforcement of work essential to health, and to substitute new forms if required.

Criminal Drunkards. A person convicted of being an habitual drunkard and of an offence punishable with imprisonment or penal servitude, may be ordered to be detained for a term not exceeding three years in any State inebriate reformatory, or in any certified inebriate reformatory, the managers of which are willing to receive him. The court is to be satisfied from the evidence that the offence was committed under the influence of drink, or that drunkenness was a contributory cause, and that the offender admits that he is, or is found by the court to be an habitual drunkard. After a plea or verdict of guilty, the same jury is then, if there is no admission of habitual drunkenness, to inquire, without being sworn again, whether the offender is a habitual drunkard.

In this connection reference should be made to the cases of *R.* v. *Meade* and *Beard* v. *Director of Public Prosecutions.*[1]

Repeaters. A person who, being an habitual drunkard, has, within the twelve months preceding the date of the commission of a fourth offence, been convicted summarily three times of any offence set forth in the First Schedule to the Act of 1898, is liable to be ordered to be detained in any certified inebriate reformatory, the managers of which are willing to receive him, for a term of not more than three years.

The Two Classes of Inebriate Reformatories. The Act of 1898 provides for the establishment and maintenance of two classes of inebriate reformatories. The Secretary of State is empowered to establish State inebriate reformatories. The Secretary of State may also make Regulations for the management of State inebriate reformatories, and for the classification, treatment, employment, and control of the inmates, and for their absence under licence. The Prison Acts apply to State inebriate reformatories, as if the latter were prisons, provided that no Regulations shall authorise the infliction of corporal punishment.

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[1] *Supra.*

Another class of inebriate reformatories, called "certified inebriate reformatories," so long as the certificate is in force, may, on the application of the council of any county or borough, or of any persons desirous of establishing an inebriate reformatory, be certified by the Secretary of State, who may make regulation relating thereto. In reckoning the period of detention in a certified inebriate reformatory, the term of imprisonment is not to be computed.

Escape of Inmates. As to escape of an inmate from a certified inebriate reformatory, or from the charge of any one under licence, before the expiration of his time, every officer authorised in writing by the reformatory managers to retake and recover shall, for these purposes, have all the powers, protections, and privileges of a constable. An escaped inmate can be arrested without a warrant.

WHAT TO DO IN A CASE OF DELIRIUM TREMENS

Notwithstanding the provisions of the Lunacy and Mental Treatment Acts 1890 to 1930, medical practitioners who act are liable to be sued for damages in connection with the steps taken by them to deal with cases of *delirium tremens*.

During an attack the patient is undoubtedly insane, and may be very dangerous; but it is an acute illness of short duration, ending rapidly in death or in sane convalescence; and thus medical evidence may easily be procured to show that a person, at a short period before or after the imposition of restraint, was in a sane state of mind, and not in a condition to justify any restraint of personal liberty.

In *Scott* v. *Wakem*, a medical practitioner, was sued for damages for having placed the plaintiff under restraint, and without necessity or authority. The plaintiff had been subject to attacks of *delirium tremens*, and on the day in question the defendant was called in to see him. He found him in an excited state with loaded pistols in his hands, threatening to shoot his wife; two men were holding him. He was then in a fit of *delirium tremens*, and in a dangerous state. The defendant placed a man in the house to watch him during the night. The usual medical attendant of the family saw the plaintiff on the following day, and he found him then quite sane and sensible, and complaining that he had been kept a prisoner in his own house by order of the defendant. It was denied that any authority for interference had been given to the defendant by the plaintiff's wife, although the evidence that she had authorised the proceedings was very strong. The plaintiff, who recovered next day, brought an action for damages.

The judge who tried the case said: "If the defendant had made out that the plaintiff was, at the time of the original restraint, a *dangerous lunatic*, in such a state that it was likely *he might do mischief to any one*, he would be justified in putting a restraint upon him, not merely at the moment of the original danger, but until there was reasonable ground to believe that the danger was over; and this would sustain one of the pleas. Or, again, if the jury were satisfied that the wife of the plaintiff had called in the defendant to cure her husband under a fit of *delirium tremens*, and that he came in to cure him, and left him when he believed he had recovered, then the defendant would be justified in what he had done, supposing that in either case he had done nothing that was not necessary or reasonably proper under the circumstances. Again, if the defendant had been called in on behalf of and for the benefit of the plaintiff, and to cure him under a fit of *delirium tremens*, and when the plaintiff recovered he himself approved what had been done, that would likewise afford a defence, supposing that nothing more than proper treatment had been adopted."

The plaintiff was awarded a farthing damages, but the medical man was necessarily put to great expense in defending the action.

Syrun v. *Fraser and Andrews* was of a similar nature.

The plaintiff was a woman who gave way to habits of drinking ; she had had an attack of *delirium tremens* two years before the trial. The defendants were called in, and attended her professionally. At the plaintiff's own request a nurse and a male attendant were provided for her by a friend, and they stated that they merely followed out the directions of the defendants regarding the plaintiff. She recovered, and after the interval of a year, brought an action against the two physicians, not for negligence or ignorance, or want of due care and skill in treatment, but for assaulting and ill-using her, and putting her under personal restraint. It was alleged that they were wrong-doers *ab initio*, and that there were no reasonable grounds to justify their proceedings. The trial ended in a verdict for the defendants.

There are three practical courses open to the practitioner, depending very largely on the financial position and other circumstances of the patient.

1. If he is a man of means and has sufficient servants in the house or if adequate attendance can be obtained, the physician should instruct the nurses in their duties, making sure that his instructions are understood, and he should retain charge until he is satisfied that his personal supervision can be dispensed with.

2. If the patient cannot afford the necessary nursing staff, the physician must explain to the relatives or friends the urgent necessity for temporary supervision, point out to them the cost, and arrange for them to order things on their own personal responsibility.

3. If neither of these courses is possible, the physician should report the case immediately to the relieving officer of the district, who must then act in his *official* capacity and take full responsibility for the case. The physician may or may not think it advisable to issue an urgency order under the Acts, but a general practitioner would be well advised not to do so on his own responsibility.

FEIGNED INSANITY

Insanity is not infrequently feigned by persons accused of criminal offences in order to prevent a trial, to procure an acquittal, or to escape the consequences of the act. Insanity is very rarely, if ever, feigned until *after* the commission of the crime ; if it were, and were detected, there could be no better proof of guilt. The point is one well worth bearing in mind in trying to diagnose the imposture.

The following is a good illustration of a case where an impostor said that he was insane, which in itself is almost a proof of malingering :—

A prisoner pleaded guilty to feloniously wounding a man with intent to murder him. The prisoner stated that he was not responsible for his actions at the time. In the opinion of the medical officer of Brixton Prison, the prisoner was sane, and his stupid manner was assumed. Seventeen previous convictions were proved against him, and he was sentenced to ten years' penal servitude.

On the other hand, the commission of a crime has sometimes suddenly led to an attack of mania in a person previously sane. A singular instance of this kind has been reported.

Many years ago two men were arrested on a charge of theft, and the police requested a shoemaker to assist them in conveying the prisoners. The shoemaker took a gun with him for better security. During the journey, one of the prisoners leaped from the conveyance and ran off. The police called to the shoemaker to fire, and he, thinking himself warranted to do so by their order, fired, and wounded the prisoner severely in the back and loins. The shoemaker was himself immediately committed to gaol. This event affected him so seriously that he became violently maniacal. When scarcely recovered he was tried for the offence, convicted, and sentenced to six months' imprisonment !

This case proves that a person may really be attacked with mania in circumstances in which a justifiable suspicion would be likely to arise that he was feigning.

The following case of feigned insanity was the subject of a trial in London :—

A woman was charged with uttering a forged cheque : she had craftily procured the signature of a person under a false pretence, and then forged his name to the cheque. When required to plead she made no answer, and appeared unconscious of the question. She took up some flowers placed in the dock, and crumbled them in her fingers, which were in continual motion. She stared wildly at times, changing her position—turned her back on the court—muttered indistinct exclamations, and made a humming noise. She was placed under some restraint in order to prevent her from jumping out of the dock. Evidence was given that at previous periods of her life she had used incoherent language and was strange in her conduct. It was also shown that her mother, aunt, and sister had been insane. One medical witness thought that the prisoner was feigning, for she appeared to be fully aware of the importance of the plea of insanity ; but when he heard that other members of the family had been insane, he thought that she was insane. Another medical witness, who had attended her family professionally, and had known the prisoner long, thought that she was not insane. Other witnesses said that they had never observed any acts of insanity about her. When arrested, she tried to escape and to conceal the money which she had procured by means of the forged cheque. The prison surgeon thought that she was feigning ; he visited her daily, and he observed that her manner was changed as soon as she saw him. She put on a wild look when she knew that she was being observed, but when privately watched her behaviour was like that of a rational person ; she generally slept soundly. The jury found that she was of sound mind ; she was then called on to plead to the charge, but she refused—a circumstance rarely observed in the conduct of an insane person. She was found guilty.

A silly case of shamming insanity occurred at the Northampton Assizes, when the judge said that it was one of those difficult cases where one could hardly tell whether the prisoner was a violent lunatic or one of that class of persons who were half mad, and more than half bad. He was, however, a very dangerous man to have at large. If the man really was a lunatic he would be removed to some place where he would no longer be punished, but properly cared for. On the other hand, if he was sane, he was a very violent and dangerous man. Sentence, ten years' penal servitude.

Another judge once said: "It may be safely held that the person feigning insanity will rarely, if ever, try to prove himself to be sane; for he runs the great risk of satisfying others that he is sane, a conclusion which he obviously desires to avoid. But there is no better proof, in general, that the insanity (supposing other evidence of it to be strong), is real, than keen and eager attempts by the accused to prove that he is sane, and strong and indignant remonstrance against being held to be insane, although they would protect him against trial and punishment."

A trial took place at Chelmsford Assizes in which a clergyman was charged with making a violent and unprovoked assault on a policeman. When a suggestion was made that his conduct was that of an insane person, he protested strongly against the jury returning a verdict to that effect. He would not allow this defence to be set up for him. His conduct, however, in court, left no doubt that he was then of unsound mind as well as when he committed the assault, and the jury, in spite of his strong protestations, acquitted him on the ground of insanity.

Forms of Insanity commonly Feigned. *Mania* is, perhaps, more frequently feigned than any other form, because the popular notion of insanity is that it consists of violent action and vociferous and incoherent language.[1]

The feigning of paranoia is a matter of some difficulty; it should be easily susceptible of detection. As in mania, the part would be overacted, and an impostor would thus betray himself. *Dementia* is more easily feigned: in general this state comes on slowly, and is obviously dependent on organic changes, as old age, apoplexy, paralysis, or hemiplegia; or it is a consequence of recurrent mania or paranoia.

Idiocy and *imbecility* could hardly be feigned successfully, because these are commonly states of congenital deficiency, *i.e.*, they must have existed from birth.

Diagnoses of Feigned from Real Insanity

It is impossible here to discuss this question very fully, but the following will be found to contain most of the general considerations. Of course, each case has its own special points.

Motive. This may be clear, as remarked above. No one shams insanity until he has committed an offence, and then the motive is fairly obvious. It is difficult to imagine circumstances in which a person would feign insanity without a motive even if it were inadequate.

Suddenness of Onset and Absence of Cause. Cause must here be assumed to mean some actual physical occurrences or obvious mental shock; the mere presence of a motive cannot be taken to be a cause, although as in the above related case the two may coincide. It, however, still remains true that in real insanity there is generally to be found some acknowledged obvious cause such as bodily disease, shock, worry, intense grief, etc., which are known to cause at times any form of acquired insanity. The anxiety occasioned by the trial of a person accused of murder may lead to some form of insanity, especially in one who from his family history is predisposed to mental disease.

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[1] In "The Road to Endor" there is a full account of the way in which two prisoners of war in Turkey managed to simulate insanity and to deceive numerous specialists.

Real insanity rarely comes on suddenly; it is far more commonly preceded by conduct which is unusual in the individual, but not amounting to insane conduct. We should observe whether for some time previously there has been any marked change of character in the person, or whether his conduct, when he had no interest to feign, presented any o the usual indications of insanity. Some difficulty may arise when fits of eccentricity or strangeness of character are deposed to by witnesses, but such evidence may be wholly contradictory and the previous acts of the person may bear no resemblance whatever to those performed by him in the recently assumed condition. A difficulty of this kind rarely presents itself, since in an imposter no act indicative of insanity can be adduced for any antecedent period of his life: it is only *after* the perpetration of a crime and its detection that any act at all indicative of insanity will be met with.

Conduct not true to Type of Insanity. In general, as in most cases of imposture, the part is over-played—the person either does too much or too little, and he betrays himself by inconsistencies of conduct and language which are never met with in cases of real insanity of the type assumed. An impostor may be induced to perform any act, if it be casually observed to another in his hearing that the performance of such an act will furnish strong evidence of his insanity.

Insomnia and the Reverse. In certain types of insanity, such as in mania, sleep is often absent for days together, but an impostor gets tired with his exertions or with the mental effort required to play his parts, and generally sleeps soundly. Moreover, the sleep of a person of unsound mind is frequently fitful and easily disturbed. Again, in mania it is not infrequent for the nights to be worse than the days.

"I am Mad." This is the cry of the impostor, and he has to maintain his *role*; with real insanity the contrary is the case, the victim will not admit that he is mad and stoutly maintains his sanity.

Observation of the Eyes and Expression. Frequently enough the person who is really insane betrays himself by the restless eyes and peculiar expression. These are not observed in the impostor as a rule. An impostor may assume a wild look and maintain great taciturnity, but he can rarely continue this imposture for long.

Conduct when apparently unobserved. This is, after all, the greatest test for malingering. In real insanity the victim behaves when he is alone just as he may do when observed; at any rate, he is likely to maintain his attitude whatever it be. The impostor drops the mask when he thinks he is alone, and can then easily be detected. In prisons there are now rooms with windows, etc., so arranged that the accused can be watched for long periods when he thinks he is unobserved.

Detection by Writing. If the person can write, he may be induced to draw up an account of himself, which might help to indicate the real state of the mind. In the different forms of insanity the writing presents characters which cannot easily be mistaken. Writing being one of the evolutionary characters which have been acquired later, is one of the first to be affected in mental diseases, and therefore is a most useful index of deterioration.

This plan may succeed in developing the existence of a latent delusion, when an examination would wholly fail; the patient would not be led to suspect that he was being subjected to an examination for a hostile purpose. He would not be influenced by the suspicion that the act of writing was to test the state of his mind; and as no man who does not think connectedly can write long in a connected manner, so we may expect to find ample evidence whether a delusion exists or not.

In idiocy there is no capacity for writing. In dementia, as memory is defective, it commonly happens that the same words or word are written over and over again. No person in a state of confirmed dementia can write a connected sentence, because before the last part of the sentence is completed the first is forgotten. In imbecility we may meet with every variety of mental defect, but the state of the mind is generally indicated by the expression of the thought in writing.

The method of writing is nearly the only plan which can be adopted when the person refuses to answer questions, and maintains a state of taciturnity for days and weeks. If furnished with writing materials, persons of unsound mind will often, in secret, voluntarily draw up petitions, addresses, or wills, which will reveal their real state of mind. For further details of this symptom the reader should consult a modern work on mental disease.

Dirty Habits. With respect to the simulation of the dirty habits of the insane, an impostor may be dirty in his cell or bed, but rarely in his person, while in real insanity the patient is usually dirty in both. In many types of insanity, however, there may be no dirtiness in habits.

Pretended becoming real Madness. A case is recorded of two sailors who had feigned madness in order to escape imprisonment in the hulks. The imposture was at first crowned with success, but in the end it had a disastrous result, for they became really mad.

The impostor must be ever on the watch that he does not fail on any one point. This creates a great strain on the mind, and with the anxiety attendant on the maintenance of such an imposition at all times, and in all circumstances, he may suffer from cerebral exhaustion with its consequences.

In **hysteria** and **neurasthenia** the question of deliberate malingering is often brought before medical men, but belongs too closely to clinical medicine to be further noted here. The reader is referred to works on clinical medicine under the headings of "Hysteria," "Neurasthenia," etc.

The Presence of Illness (not necessarily Pyrexial) known to cause Madness. Myxœdema, syphilis, gout, exophthalmic goitre, plumbism, Bright's disease, and a few other diseases are known to be capable of causing madness, and therefore their presence or absence should be investigated. Encephalitis lethargica commonly causes mental deterioration and loss of moral sense.

The following case shows that impostors occasionally succeed, or have succeeded in the past.

In *R.* v. *Ball*, a ticket-of-leave convict was convicted of housebreaking. After he had been committed to prison, he simulated madness so successfully that he deceived three of the visiting justices and two medical men. A certificate was about to be signed for his removal to a mental hospital, when the deception was discovered in consequence of the impostor having made a confidant of one of his fellow-prisoners. He had been convicted of robbery at Leicester: he was sent to prison, where he feigned insanity and succeeded in deceiving the medical officers there: they certified him as insane, and he was accordingly removed to Bethlem Hospital, where he remained two years.

Feigned Deaf-Mutism

For the same purpose of evading responsibility, persons may feign to be deaf and dumb. Such cases of malingering come much more frequently before the medical man in his primary capacity than when acting as a witness, but they may be noted here. Occasionally they occur in police-court cases where the minor offence, for example, of begging is in question, or obtaining charity by false pretences. It will be found that the alleged deafness and dumbness did not appear until a motive for feigning existed, and that there was no apparent cause except that of evading responsibility for an offence. The use of ether or chloroform vapour may occasionally be resorted to with advantage, but a careful medical examination is usually sufficient to detect the imposture.

In one instance a strong shock of the induced current from a magneto-electric apparatus, by means of moistened conductors applied over the larynx, brought out after a few minutes the power of speech in a lad who had successfully imposed on many persons.

It requires great skill to maintain an imposture of this kind. Such persons are immediately thrown off their guard by addressing them in a voice a little above or a little below the common conversational tone; a change in the eye or the features will at once indicate that they hear and understand what is said. An ignorant impostor may be dealt with on the principle of "*ars est celare artem*," by seriously proposing in a low voice to a medical friend who may be present, the necessity for the performance of some formidable surgical operation. The production of amputating instruments has been known to have a wonderful effect. On one occasion a rate-aided person who was feigning deafness and dumbness was detected as a result of the production of a case of surgical instruments during a consultation between two surgeons as to their intention to perform an operation upon him immediately.

In *R.* v. *Yaquierdo*, the prisoner, who was charged with murder, was found by the jury to be wilfully mute. The man refused to plead, although it was obvious that he was well aware of the nature of the proceedings. No counsel could be assigned to him, as this could not be done without the prisoner's consent. He was convicted.

An impostor succeeded in convincing all around him that he was completely deaf. His medical attendant orally prescribed for him daily extra wine and other articles of dietary, but in reality he ordered that none of them was to be supplied. The consequence was that whilst the patient was nominally living on the fat of the land, he was actually suffering from hunger. At last the surgeon remarked that he could not understand why the patient seemed to be losing flesh with such a diet. This proved too much, and the pretended deaf man, in an unguarded moment, indignantly exclaimed to the nurse, "You know I have never had any of those good things."

If the impostor can write, he may perhaps be detected by the ingenious plan adopted by the Abbé Sicard.

When the deaf and dumb are taught to write, they are taught by the eye. The letters are known to them only by their form, and their value in any word can be understood only by their exact relative position with respect to each other. An impostor will spell his words or divide them incorrectly; and the errors in spelling will always have reference to sound—thereby indicating that his knowledge has been acquired through the *ear*, and not alone through the eye. An man who had defied all other means of detection wrote down several sentences, in which the misspelling was obviously due to errors produced by the *sound* of the words; the Abbé pronounced the man to be an impostor without seeing him, and he subsequently confessed the imposition.

A curious case in which a deaf mute was declared by law to be insane "under the Act" will be found discussed by Mercier in the "Trans. of the Med.-Leg. Society" for 1908-09.

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